Received: 11 December 2019 | Accepted: 12 December 2019
DOI: 10.1002/ca.23544

CLINICAL ANATOMY WILEY

#ANZACA2019 – 16th Annual Meeting of the Australian and New Zealand Association of Clinical Anatomists "The Modern Anatomist: Where Are We Now and Where are We Headed? 4–6 December 2019 The University of Western Australia, Perth, Australia

Seventy one delegates from around Australia, New Zealand, Poland, India, Canada, Scotland, South Africa, Thailand and the United Kingdom attended the 16th annual conference of the Australian and New Zealand Association of Clinical Anatomists held at The University of Western Australia (UWA) in Perth, Australia, from 4-6 December 2019. The theme of the conference was: "The Modern Anatomist: Where are we now and where are we headed?"

Three pre-conference workshops were held on the first day by: Gold Sponsor, Dr Anthanasios Raikos (CEO, 3D Organon); Dr Amanda Meyer (Chair; UWA); and Mentorship Program Director Associate Professor Michelle Lazarus; Monash University).

Professor Claire Smith (University of Sussex) presented the first keynote address on: "The Known and Unknown Secrets of Anatomy Learning". Later the same day, Professor Smith conducted an interactive keynote workshop: "Naked Anatomy: delivering ultrasound and living anatomy to medical students".

Associate Professor Lisa Lee (University of Colorado) presented the second keynote address on: "Holistic integration in anatomical sciences education: content, competencies, pedagogies, can we do it all?" Her keynote workshop later that day was on: "Mindful mining of the digital goldmine, Virtual Microscopy Database to support learners and educators".

During the conference, students and academics presented twenty one 10-minute oral presentations and forty six 2-minute oral presentations of posters to the delegation.

The conference was kindly sponsored by: 3D Organon, Primal Pictures, WolfVision, McGraw Hill Education, Southern Biological, Curtin University and Fujifilm SonoSite.

Presentation winners were: Associate Professor Quentin Fogg (University of Melbourne, Best Clinical Anatomy Research Oral Presentation), Mr Connor Blythe (Queensland University of Technology, Best Clinical Anatomy Research Poster Presentation), Mr Toby

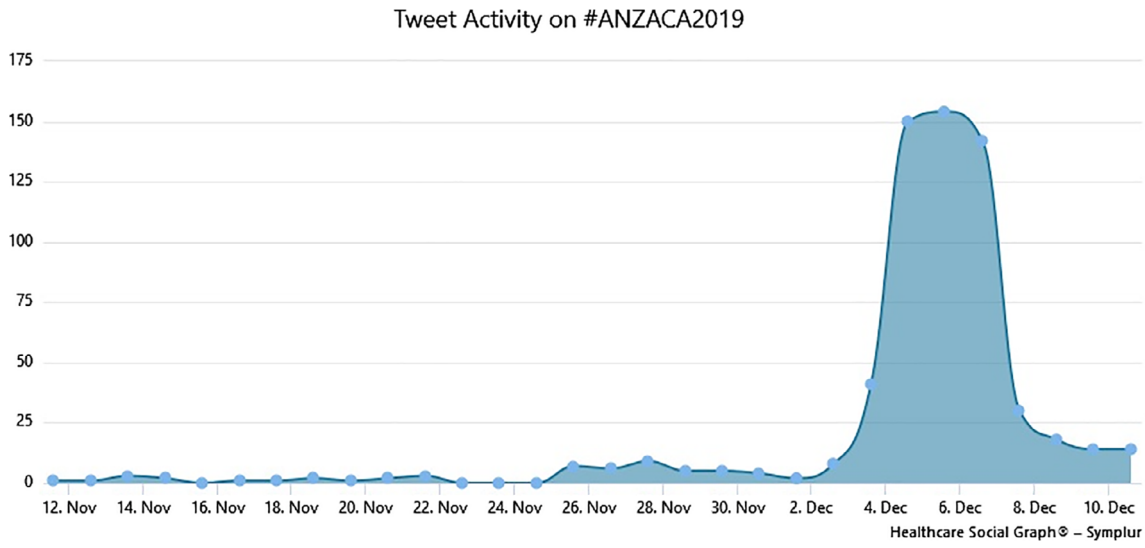

FIGURE 1 Tweet activity of #ANZACA2019 supplied by Symplur [Color figure can be viewed at wileyonlinelibrary.com]

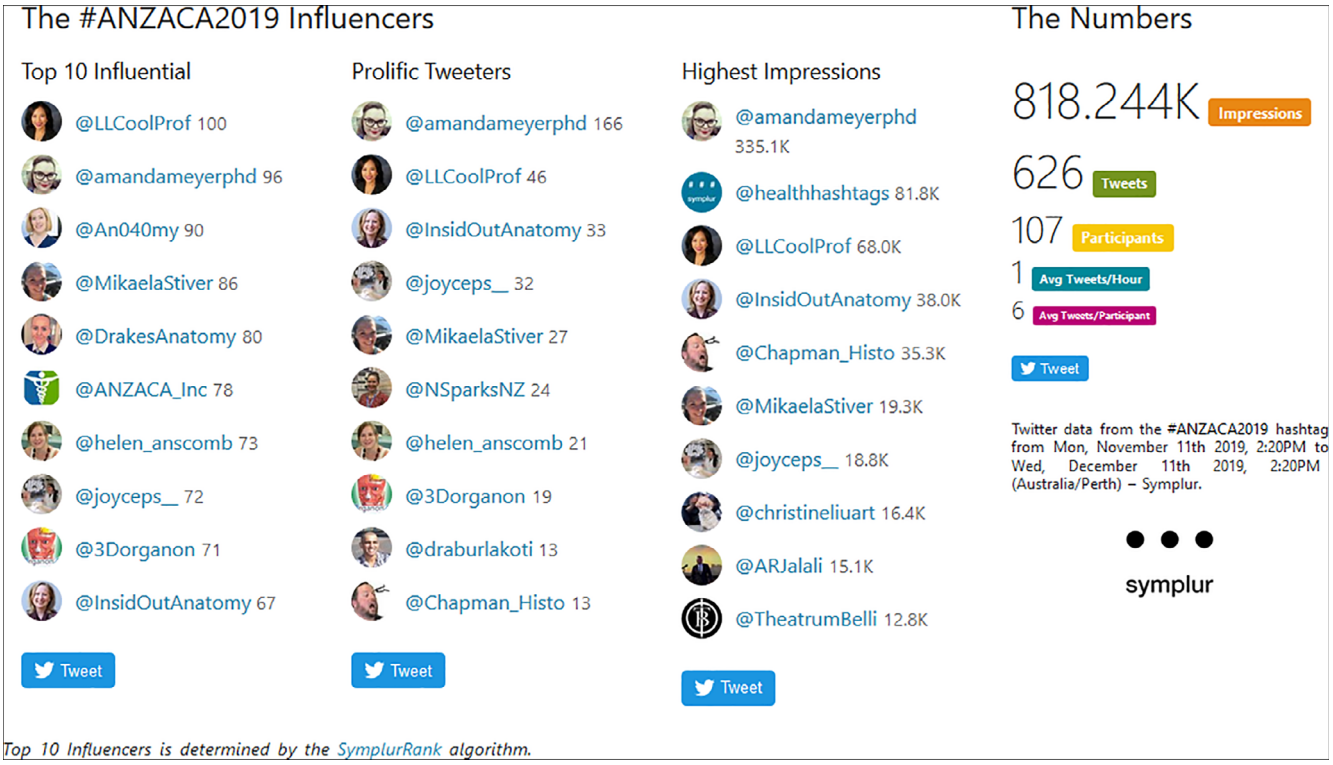

FIGURE 2 Tweet activity of #ANZACA2019 supplied by Symplur [Color figure can be viewed at wileyonlinelibrary.com]

Branson (University of Adelaide, Best Education Research Oral Presentation) and Ms Niina Matthews (Western Sydney University; Best Education Research Poster Presentation)

Delegates tweeted about the conference using the hashtag #ANZACA2019. Tweets peaked during the first official day of the conference, Thursday December 5, 2019 (n=157; Figure 1). Data gathered from the hashtag from 11 November to December 11, 2019 by Symplur demonstrated over 818, 000 impressions, and 626 tweets by 107 participants (Figure 2). The top 10 most influential tweeters identified as female (n=8) or organisations (n=2; Figure 2). Twitter is a great way to engage the anatomy community in current research.

The 17th annual meeting will be held at The University of Otago's campus in Christchurch, New Zealand, in early December 2020

Dr Amanda Meyer (UWA), Dr Beatriz Ito Ramos De Oliveira (Curtin University) and Dr Mauro Vaccarezza (Curtin University).

ORAL PRESENTATIONS – SESSION 1

Understanding the sex bias in cadaveric perceptions

T. DRAKE and L. S. GREGORY
School of Biomedical Sciences, Queensland University of Technology, Brisbane, Australia

INTRODUCTION: Whilst dealing with cadavers can be a confronting experience, students and educators alike recognize that it is an essential practice to develop deeper anatomical understanding. This project aimed to investigate the association between student demographics and their preparedness to work with donor material. **MATERIALS AND METHODS:** Before their first class, students enrolled to study anatomy at the Queensland University of Technology (n = 798; 442 females; 271 males; 85 unspecified) completed anonymous surveys on their perception of seeing and handling human donor material. The association between student perceptions, and age, sex, religion and course of study were evaluated using a Chi-Squared test for independence. **RESULTS:** Although 50% of students indicated positive feelings to viewing donor material, the sexes were disproportionately represented with 63% of males having a positive outlook compared to only 42% of females (P = 0.0001). Females were twice as likely to find it confronting (P = 0.016) and express concerns for mental health (P = 0.0001), however they felt more fortunate for the experience than their male counterparts (P = 0.003). Although there were no significant associations between age or religion, and student perceptions of cadavers, significant associations were observed between course of study and concerns raised by students, with engineering students most concerned with their mental health (37%), nursing/paramedic students most concerned with damaging the specimens (41%) and business students most likely to say they had no concerns (28%)(P = 0.014). **CONCLUSION:** To adequately support and ensure the success of students, class demographics should be considered when introducing students to cadaveric material for the first time.

Taking anatomy teaching on country: Lessons from a rural placement for medical students

L. BOSTON[1], D. GRIFFITHS[2], R. HALL[2], B. T. MAJDA[2], B. MA[1], P. K. NICHOLLS[1] and D. PAUL[2]
[1]Murdoch University, Murdoch, Australia; [2]University of Notre dame, Fremantle, Australia

INTRODUCTION: We were challenged with replacing part of a university campus-based anatomy teaching program, including human cadaveric material and fresh non-human animal tissues, with an equivalent educational experience for a subgroup of medical students attending a rural placement, "Broome ~ learning On Country," as part of their training. **MATERIALS AND METHODS:** We employed a suite of techniques including tools within the Moodle Learning Management System, anatomical models, imaging, and commercially available anatomy software in a tutored rural classroom setting. The student experience was surveyed through standard university instruments. **RESULTS:** Qualitative and quantitative feedback indicated that the alternative program delivered in a remote environment was an adequate replacement for that delivered in the city campus setting. **CONCLUSION:** We felt confident in expanding our On Country learning program for medical students to include further components of the medical program, and adopting some of the components into a more flexible learning environment for all students. The findings may help uncouple learning from the need for specialist teaching facilities, to give flexibility of learning in both time and space.

POSTER PRESENTATIONS – SESSION 1

Simple innovations in anatomy practical classes to promote language and visuo-spatial learning

C. M. BARRY
College of Medicine and Public Health, Flinders University, Adelaide, South Australia

INTRODUCTION: Anatomy requires learning in visuo-spatial and verbal domains. We recognize both types of learning are promoted when students actively interact with each other and with available material in the anatomy laboratory. Aiming to encourage this interaction and improve students'' confidence in foundational knowledge including use of terminology and recognizing orientation of structures, we altered class structure and assessment methods. **MATERIALS AND METHODS:** Students enrolled in two third year undergraduate anatomy topics were allocated to groups of 4 and undertook a 20-minute, team-based task during each 2-hour practical class. Each 40-question quiz focused on consolidating, testing and providing feedback regarding core anatomy content including visuo-spatial and verbal knowledge, and in total contributed to 20% of students' final grades. **RESULTS:** Attendance improved from approximately 75% to over 90%. During the task, student interactions with each other and learning materials was high. The proportion of students who failed the topic decreased from 5% to 2%. Student Evaluation of Teaching improved for the domains "The feedback I received helped me learn" from 71% ± 20% agreement to 89% ± 16%. The domain "I had a clear idea what was expected on me" also improved from 92% ± 7% to 96% ± 6% agreement. Total enrolments in the 2 topics for this period increased slightly from a total of 250 to 264 students. **CONCLUSION:** Simple laboratory tasks that incentivize student interaction using existing materials can promote visuo-spatial and language learning and have a substantial impact on student success and satisfaction in anatomy topics.

Evaluation of flipped classroom as a tool to enhance higher-order clinical anatomy thinking

A. BABRI
Department of Anatomy and Developmental Biology, The University of Queensland, Australia

INTRODUCTION: Flipped classroom (FC) has emerged as the pedagogy of choice among 21st century educators and learners. FC's recognition is due to its leverage in utilizing student-centered and active learning principles– blending the learning, which helps improve understanding and application of concepts beyond memorization. Literature lacks evidence that FC enhances higher-order thinking. By utilizing clinical/surgical anatomy concepts we evaluated the effectiveness of FC to encourage higher-order thinking. **MATERIALS AND METHODS:** Clinical anatomy concepts were delivered during six two-hour sessions to a Master of Nursing cohort (n = 45). Each session had four blocks: (a) Take-off, (b) Climb, (c) Cruise and (d) Descent & Landing. Student feedback was collected using institutional surveys. **RESULTS**: A majority of respondents (85%) agreed that flipping promoted better learning. They also reported that FC significantly improved ability to apply learned knowledge and critical thinking. 93% agreed that the methodology was an important tool to evaluate clinical case scenarios. High scores were reported on both effectiveness of facilitator (86%: 5/5) and ability to evaluate, analyse, apply & understand essential biomedical concepts (93%: 5/5). **CONCLUSION:** The results of this evaluation indicate that "flipping the classroom" has greater effectiveness over traditional pedagogies. A positive correlation between students' grades and higher-order thinking was also identified. It also showed that FC's student-centered approach with a greater mixture of activities (VoPP, concept maps and recommended readings) positively improved a learner's ability to apply anatomical concepts in a clinical setting.

Improvement of knowledge of human anatomy in first year medical students by 3-D software based teaching

D. AGRAWAL[1], S. GHATAK[1], and G. A. AGRAWAL[2]
[1]All India Institute of Medical Sciences, Jodhpur, India; [2]Sri Ganganagar College of Ayurvedic Science & Hospital, Sri Ganganagar, India

INTRODUCTION: This study was done with overall goal to increase core knowledge of Human Anatomy among medical undergraduates by 3-D software based teaching and assessment of its impact on their knowledge. **MATERIALS AND METHODS:** This study includes first year undergraduate medical students (MBBS) (n = 100) studying in All India Institute of Medical Sciences, Jodhpur, INDIA. The three Anatomy lecture topics by conventional method and other three by using 3-D Anatomy software were taught to these students. Each lecture is supplemented with pre-& post-test and feedback questionnaire to assess effectiveness of teaching methodology. Scores recorded from pre/post-test, & feedback questionnaire were analyzed statistically. **RESULTS:** A) Comparison of pre and post-test scores for each lecture-many of students scored better in post-test. B) Most of the students shows statistically significant difference ($P < 0.05$) in gain scores in software based teaching than traditional. C) Feedback from students-students preferred the software-based teaching. **CONCLUSION:** Student performance was very positive and the authors were of the opinion that this technology based technique has a great potential. In this study the opinion of students about various active teaching methods revealed that use of 3-D software and Audio-visual aids is the most favored one.

Undergraduate medical students' perception towards the various teaching modalities in anatomy

R. PUNJA, M. HOSAPATNA, and S. SUMALATHA
Kasturba Medical College, Manipal, Manipal Academy of Higher Education, Manipal, Karnataka, India

INTRODUCTION: Anatomy, one of the subjects of the basic medical sciences, is recognized as an essential foundation for clinical sciences. However, there is a continuing debate on the best method of teaching anatomy. In this study, we infer the perception of the first year medical students on the various teaching modalities of Anatomy. **MATERIALS AND METHODS:** The present study was conducted on 246 first year undergraduate medical students. An online platform [Survey Monkey] was used with 15 structured questions which were easily comprehensible relating to the current teaching-learning practices of anatomy. **RESULTS:** Small Group Teaching scored the highest (80%) as the best method through which they were able to grasp the subject. Didactic lectures scored the least (12%). The best teaching aid which complemented didactic lectures were videos (38%), PowerPoint slides (29%) and chalk and talk (18%). Integrated teaching introduced as talks by physicians (31%) and problem-based learning (28%) was not well appreciated. Exposure to the clinical side, where small groups are taken to the hospital to demonstrate relevant case/procedure/examination had a significant impact (78%). Fifty nine percent of the students were happy with the prosected specimens, while 50% of the students felt dissection under the guidance of expertise is the right way of learning anatomy. **CONCLUSION:** Anatomy exposes the student to an ocean of knowledge, how it gets imparted, and the best manner in which a student would retain such information is paramount.

An evaluation of the concept of professionalism at the university of Kwazulu natal's medical curriculum

L. LAZARUS, J. NAIDOO, and K. S. SATYAPAL
Discipline of Clinical Anatomy, University of KwaZulu-Natal, Durban, KwaZulu-Natal, South Africa

INTRODUCTION: Incorporating the teaching of professionalism in an undergraduate medical curriculum is a challenging process. In South Africa, a number of pressures have been eroding medical professionalism including health care system reform, economic constraints and resultant conflicts of interest. Owing to these influences, and the exodus of dedicated professional role models from public hospitals and medical schools in South Africa, it cannot be assumed that medical students will automatically acquire desired attributes for their profession, without planned curriculum interventions. This study outlines how the School of Clinical Medicine at the University of KwaZulu Natal (UKZN), South Africa addresses the teaching of professionalism in a six-year undergraduate medical curriculum. **MATERIALS AND METHODS:** Evaluation of The College of Health Sciences handbook of UKZN reflected the current strengths and weaknesses of teaching professionalism in the undergraduate medical curriculum. **RESULTS:** Aspects of professional practice were mentioned in the following modules viz. CMED1EN, CMED1PC CMED4CH MC, CMED4EL MC, CMED4II MC, CMED4IM MC, CMED4PC MC, CMED5MH MC, CMED5PC MC at first, fourth and fifth years of the curriculum. Skills identified were "*to equip the undergraduate medical student with sufficient knowledge, clinical, technical and professional skills to meet priority community needs*" and "*to introduce the student to the competencies required to become a competent, professional, caring, thinking clinician*". **CONCLUSION:** Incorporating professionalism in the curriculum is an ongoing process and although much remains to be done, one must also acknowledge that much has been achieved. Both staff and students are more sensitized to issues relating to professionalism.

Popliteofibular ligament of the knee: A meta-analysis

J. R. PĘKALA, P. A. PĘKALA, P. PASIEKA, M. P. PAZIEWSKI, and K. A. TOMASZEWSKI

Jagiellonian University Medical College, the international Evidence-Based Anatomy Working Group

INTRODUCTION: The popliteofibular ligament (PFL) is a part of posterolateral corner (PLC) of the knee. Its role is to improve stability of the joint. As the whole PLC area, it is poorly described in literature. We aimed to perform meta-analysis to describe prevalence and characteristics of PFL to lighten clinical picture of the structure. **MATERIALS AND METHODS:** The search o medical databases was performed to identify relevant articles. The data were extracted and statistically analyzed. PRISMA guidelines were respected throughout the study. **RESULTS:** We identified 36 relevant studies (n = 1,284 limbs). PFL was absent 5.9% (95%CI 1.9–11.7) of the time. In European studies, prevalence of absence was 17.9% (0.0–45.8) compared to 20.0% (95%CI 2.9–44.7) of limbs examined in Asian studies and 16.0% (0.0–43.4) of North American ones. Mean length of posterior face was 11.6 mm (11.4–11.8) compared to anterior face's length of 14.3 mm (14.0–14.5). Midway width was 7.0 mm (6.8–7.2). **CONCLUSION:** PFL has been proved to be very highly prevalent structure of modest size. The surgeon should be aware of it when performing surgeries in the area.

The clinical and anatomical significance of meniscofemoral ligaments

M. P. PAZIEWSKI[1], P. A. PĘKALA[1], J. R. PĘKALA[1], P. M. PASIEKA[1], K. A. TOMASZEWSKI[1, 2], and J. A. WALOCHA[1]
[1]*Jagiellonian University Medical College, The International Evidence-Based Anatomy Working Group, Kraków, Poland;* [2]*Andrzej Frycz Modrzewski Krakow University, AFMKU, Department of Orthopaedics Trauma Surgery and Rehabilitation, Kraków, Poland*

INTRODUCTION: Two meniscofemoral ligaments (MFLs), i.e., anterior (aMFL) and posterior (pMFL), for long time have been considered vestigial structures of little to no significance. Consequently, our purpose was to conduct a meta-analysis to sum up the progress and propose updates to present practice guidelines. **MATERIALS AND METHODS:** Thorough search of all major medical databases was performed to identify relevant articles, with focus on studies published in recent 15 years. PRISMA guidelines were strictly followed on all stages of analysis. **RESULTS:** Sixty one articles were enrolled in the analysis. The mean pooled prevalence of aMFL was examined in studies comprising a total of 4,366 lower limbs. It was present in 56.2% of the knees. It was more prevalent among males (37.2% vs. 29.1%) and on the right side (53.4% vs 46.6%). As for morphometrics, on average aMFL's length was 23.00 mm (95%CI 22.8–23.5 mm), thickness - 1.7 mm (95%CI 1.6–1.8 mm). The prevalence of pMFL was studied in 5,056 lower limbs. Its prevalence was 71.0% (95%CI 64.3–77.2%), significantly higher compared to aMFL. It was more often present in females (81.1% vs. 76.7%) and on the right side (56.1% vs. 43.9%). On the average, the ligament was 27.4 mm (95%CI 27.1–27.7 mm) long and 2.5 mm (95%CI 2.4–2.5 mm) thick. Both MFLs coexisted in 33.4% (95%CI 22.1–38.6%) of limbs, while both were absent in 7.2% (95%CI 2.7–11.8) of knees. **CONCLUSION:** In conclusion, we found both ligaments to be highly prevalent structures. Their size suggests bigger role in stabilization of knee than was previously suspected.

A plantaris muscle with a unilaterally present bicipital head

N. MATTHEWS and M. DAYAL
Western Sydney University, Sydney, Australia

INTRODUCTION: Part of the triceps surae group, the plantaris is a small muscle in the posterior aspect of the knee. Due to its minor role in assisting in plantar flexion of the foot and flexion of the knee, the plantaris tendon can be used as a graft. An incidental finding of a plantaris muscle with a bicipital head was made during a dissection of a knee joint. Further investigation on seven other specimens was thus carried out. **MATERIALS AND METHODS:** Eight plantaris muscles were investigated for their origin, insertion, and presence of a bicipital head. The width of the origin and the length of the muscle and the plantaris tendon were measured. Of the eight specimens six were unilateral while two were from the same donor. The unilateral muscles were observed and measured in situ whereas the bilaterally observed plantaris were measured after removal. **RESULTS:** Of the eight plantaris muscles investigated, one presented with a bicipital head. The distal main bundle of the bicipital plantaris originated deep to the lateral head of gastrocnemius while the proximal secondary bundle reached over the lateral femoral condyle attaching to the intermuscular septum. Distally the two distinct muscle bellies conversed to form a single tendon. **CONCLUSION:** the importance of the plantaris muscle is under debate, however, hypertrophy or significant variation to its structure may contribute to vascular and nerve supply disruption to the leg. Research into the function of this muscle could challenge its perceived vestigial nature.

Association of morphology and density of the telocyte-like cells with age and calcification status of the human aortic valves

B. SOLEWSKI[1,2,3], M. LIS[1,2,3], J. CHRZANOWSKI[1,3], K. WITKOWSKA[1,2,3], M. K. HOŁDA[2,4], J. A. LITWIN[3], and G. J. LIS[3]
[1]*Faculty of Medicine, Jagiellonian University Medical College, Krakow, Poland;* [2]*Department of Anatomy, Jagiellonian University Medical College, Krakow, Poland;* [3]*Department of Histology, Jagiellonian University Medical College, Krakow, Poland;* [4]*HEART – Heart Embryology and Anatomy Research Team, Jagiellonian University Medical College, Krakow, Poland*

INTRODUCTION: Recently, telocyte-like cells, co-expressing CD34 and PDGFRα, have been identified in human cardiac valves. Their detailed distribution and morphology have not been investigated yet. Our goal was to analyze the location and phenotypical variability

of the CD34/PDGFRα+ cells in normal and minimally calcified human aortic valves and to examine potential link with the occurrence of early signs of calcific degeneration. **MATERIALS AND METHODS:** Twenty eight macroscopically healthy human aortic valves were obtained at autopsy. Histological, histochemical, and immunohistochemical methods (for CD34/PDGFRα antigens) were used. In addition to paraffin sections, we prepared the whole-mount specimens which were later analyzed using a laser scanning confocal microscope. Their unique 3D structure was reconstructed with Imaris software (Bitplane, Zurich). **RESULTS:** The CD34/PDGFRα+ telocyte-like cells were non-uniformly distributed within the layers and specific areas of the valve leaflets. Their density was negatively correlated with age ($r = -0.66$; $P < 0.001$) and was associated with calcification status ($P < 0.05$), while their histomorphology was related to age. We have identified three morphological types of cells: oval-shaped with no revealing projections, elongated with single, long projections and complex with numerous branching prolongations. **CONCLUSION:** The results suggest a link between valve degeneration and telocyte-like cells morphology. Telocytes are considered to be responsible for self-regeneration of tissues; therefore, it seems that a reduction in the number of CD34/PDGFRα+ cells may facilitate valve degeneration. These cells might be important targets for new therapies preventing adverse tissue remodeling which occur in the aging valves.

An anatomical investigation into dural septations at the intracranial aspect of the jugular foramen

J. NAIDOO, C. O. RENNIE, K. S. SATYAPAL, and L. LAZARUS
Discipline of Clinical Anatomy, University of KwaZulu-Natal, KwaZulu-Natal, South Africa

INTRODUCTION: The jugular foramen (JF) is a complex cranial foramen between the temporal and occipital bones. Neurovascular structures passing through the JF include the glossopharyngeal (CNIX), vagus (CNX) and accessory (CNXI) cranial nerves, as well as the internal jugular vein. The JF has been noted as being divided by a fibrous septum with dural origins. Due to the complexity of the JF, as well as cases such as glomus jugulare tumours, a thorough knowledge of the anatomical variations of septations of the JFis imperative to neurosurgical perspectives. **MATERIALS AND METHODS:** This study was undertaken on bilateral JF of thirty cadavers (n = 60). The JF was observed for any dural septation present, and cranial nerves were determined via their emergence from the brainstem. The presence of dural septa, and in which compartment cranial nerves traversed, was used to determine the type of dural septation. **RESULTS:** The types of JF according to the classification by Tubbs et al. (2015) were as follows: Type I: A septation was present between CNIX anteriorly, and CNX with CNXI posteriorly 29/60 (48.33%).Type II: No dural septation was present 26/60 (43.33%). Type III: A septation was present between CNIX and CNX anteriorly, and CNXI posteriorly 2/60 (3.33%).Type IV: Multiple dural septations were present 3/60 (5%). **CONCLUSION:** Due to the paucity of literature pertaining to the dural septations at the intracranial aspect of the JF knowledge of the variations of the JF becomes valuable to clinicians in an attempt to minimize iatrogenic injury.

The prevalence and anatomical significance of popliteal arcuate ligament

P. PASIEKA, M. MANN, P. A. PĘKALA, J. R. PĘKALA, M. PAZIEWSKI, A. BAGIŃSKI, and K. A. TOMASZEWSKI
Department of Anatomy, Jagiellonian University Medical College, Krakow, Poland

INTRODUCTION: The arcuate ligament (AL) is a component of posterolateral corner (PLC). Its role is to stabilize the joint by restraining external rotation, varus angulation and posterior tibial translation. ALis poorly described in literature, which leads to overlooking of the injuries of the complex. Our aim was to conduct the meta-analysis assessing the prevalence of AL to raise awareness about possibility of AL and PLC injuries. Our second aim was to compare the prevalence of AL between patients of different ethnicities. **MATERIALS AND METHODS:** The search of all the major medical databases was performed to identify all valid articles. Afterwards, the data extraction and statistical analysis was conducted. PRISMA guidelines were strictly adhered to during the analysis. **RESULTS:** Thirty articles compiling data from 1,286 lower limbs were included in the analysis. The mean pooled prevalence of absence of the AL was 18.0% (95%CI 7.8–31.0%) and was significantly higher in MRI studies compared to the cadaveric ones (45.8% vs 13.5%). Taking into consideration geographic subgroups, the prevalence of absence was 25.8%, 95%CI 6.7–50.7 in studies from Asia and 17.9 (95%CI 0.0–45.8%) in studies from Europe. Mean pooled prevalence of absence was 13.5% (4.3–26.2) for cadaveric studies and 45.8% (14.5–78.8) for MRI studies. The heterogeneity, measured with I-squared test, was substantial. **CONCLUSION:** In conclusion, our meta-analysis shows that AL is highly prevalent structure that should always be paid attention to during surgeries on PLC region.

ORAL PRESENTATIONS – SESSION 2

Anatomical skill management at Flinders University: Transitioning between two-dimensional and three-dimensional data

A. DALRYMPLE, C. M. BARRY, R. HABERBERGER, and L. SCHUWIRTH
College of Medicine and Dental Health, Flinders University, South Australia, Australia

INTRODUCTION: Transitions between two-dimensional (2D) and three-dimensional (3D) data will increasingly guide care as doctors more frequently combine different representations of pathology. We investigated whether students more accurately transition between 2D and 3D data when they supplement conventional materials (CM) with the Anatomage Table®(AT). Additionally, we introduced cadaveric computed tomography (CT) scans into the preclinical dissection course to stimulate development of this skill. **MATERIALS AND METHODS**: In crossover studies (CS) 1 (2017–2018) and 2(2019), participants were randomly allocated to group A or B. In sequence one (S1), A had additional access to the AT while B used CM alone. The groups switched interventions in sequence two (S2). In CS1, each sequence involved a pre-test (PT), post-test (PoT), and retention test. CS2 was characterized by GUIDED use of the AT, with each sequence involving a PT and PoT. Data were analysed using Friedman Tests (FT). A *P*-value <0.05 was considered significant. **RESULTS**: CS1: FT1 Group A (n = 10) S1 $P = 0.879$. FT2 Group A (n = 7) S2 $P = 0.311$. FT3 Group B (n = 12) S1 $P = 0.028$. FT4 Group B (n = 10) S2 $P = 0.846$. CS2: FT5 Group A (n = 3) S1 $P = 0.083$. FT6 Group A S2 $P = 0.083$. FT7 Group B (n = 5) S1 $P = 0.157$. FT8 Group B S2 $P = 0.025$. Ninety percent of Likert survey respondents (n = 110) agreed or strongly agreed exposure to cadaveric CT scans improved their ability to interpret normal "living" axial images. **CONCLUSION**: Only GUIDED use of the AT (CS2) improved transitions. The survey results support the inclusion of cadaveric CT scans in preclinical anatomy teaching.

Guided visuospatial instruction in anatomy improves 3-dimensional recall and is not influenced by EEG recording

T. BRANSON[1], L. SHAPIRO[2], M. GOLDSWORTHY[1], and I. JOHNSON[3]

[1]*The University of Adelaide, Australia;* [2]*The University of Cape Town, South Africa;* [3]*Macquarie University, Sydney, Australia*

INTRODUCTION: We previously reported improved learning outcomes for visuospatial education in anatomy. As a prelude to determining whether this correlates with changes in the electroencephalography (EEG) signal, we conducted a similar experiment to determine whether any effects on learning can be attributed to a focused visuospatial directive. **MATERIALS AND METHODS:** Thirty undergraduate students enrolled in a health-related discipline were randomly assigned into two groups of 15. Each participant was fitted with a 64-lead electrode EEG cap prior to a teaching session with three main components: (i) a 10-min pre-recorded didactic osteology lecture, (ii) a 15-min pre-recorded visuospatial workshop and associated drawing task, and (iii) a 20-item quiz on the first lecture. In both groups the first and last component were delivered equally, with only the format of visuospatial delivery in the second component differing – Group (B) receiving instruction from a *Haptico-Visual Observation and Drawing* (HVOD) workshop, Group (A) completed these same tasks without guidance. EEG recordings were taken throughout. **RESULTS:** No significant difference for mean academic scores was found (A = 12.4 ± 2.3, B = 13.1 ± 2.9), although an 11% improvement was seen in group B for visuospatial questions alone ($P < 0.05$). Almost no task distraction, resulting from EEG recording was reported by either group (A: 100% BA, B: 94% BA) - while there was good broad agreement that the task was engaging (A: 94%, B: 100% BA). **CONCLUSION:** Guided visuospatial instruction results in a better ability to comprehend 3-dimensional anatomical structures and is not influenced by EEG recording.

Factors to consider in the instructional design of virtual learning resources for anatomy education

N. S. BIRBARA and N. PATHER

School of Medical Sciences, UNSW Sydney, NSW, Australia

INTRODUCTION: With the increasing use of virtual learning resources (VLRs) for anatomy education, it is important that their design promotes effective learning. This study aimed to investigate factors that should be considered in VLR design such as delivery modality, physical fidelity and prior knowledge and university experience. **MATERIALS AND METHODS:** VLRs were developed for multiple delivery modalities and for different anatomical topics (e.g., skull, heart and liver anatomy). Participants were voluntarily recruited to trial the VLRs and provide feedback through completing a perceptions survey. Learning outcomes were measured through pre- and post-tests. **RESULTS:** Analysis of the survey and test data indicated that delivery modality is a significant factor, with desktop delivery reducing the physical discomfort, disorientation and mental effort associated with immersive modalities. User control was also perceived as an important factor, provided that the interface is familiar. For synchronous collaborative use, an interface that supports natural gestures can facilitate communication. Interestingly, VLR design needs to consider students' level of prior knowledge, as this has significant impact on learning. When there is minimal prior knowledge attained, high fidelity VLRs appear to facilitate knowledge improvement due to associations with traditional learning experiences. Overall, the data demonstrate that VLRs are more effective when prior knowledge has been attained as novice learners are distracted from learning by the novelty of the experience. **CONCLUSION:** If VLR design is to optimize learning, the principles of design potentially differ from game design in that they should be student and learning centered.

Anatomy teaching via ultrasound based learning

C. CORVALAN DIAZ

University of Sydney, Australia

INTRODUCTION: Many applied ideas and tools for teaching anatomy have been published worldwide including dissection or

prosection of bodies by students, casting, body painting, 3D printing, software, audio-visual material, and others. Their common key aim is the enhancement of the teaching approach and later, securing the acquired knowledge. Using imaging techniques is another teaching resource, not only for students to better understand anatomy in-situ but also to teach gross anatomy. **MATERIALS AND METHODS:** During the last two years The University of Sydney have added ultrasound-based teaching in five subjects (head and neck, advanced visceral anatomy, anatomical imaging, Med 2 and anatomy for critical care). For some of these subjects, the focus was to introduce the students to ultrasound techniques followed by applying it within anatomy lectures. The applied methods have varied: i) Hands-on lectures where students perform an ultrasound exam and find structures based on their anatomical knowledge; ii) the use of organs submerged in water and iii) the use of part of our fetus collection; each one of these ultrasound-based teaching experiences rated very well with students. **RESULTS:** We were able to observe the current anatomical knowledge through its application in ultrasound workshop. The feedback received by students and their perception after class was excellent, the possibility of working in hand on mode was the best evaluated. **CONCLUSION:** This poster has described the different applications of ultrasound in teaching anatomy, its applicability in each subject and summarized the experience of this teaching method.

POSTER PRESENTATIONS – SESSION 2

Reinforcing cardiac cycle using concept of murmur timings: A comparison of different teaching strategies

D. PUNJA, C. AJITH, K. NAYAK, and K. PRABHU
Kasturba Medical College, Manipal Academy of Higher Education, Manipal, India

INTRODUCTION: Timing cardiac murmurs is a clinically relevant context that lends itself well to application in cardiac cycle teaching. This study compared different educational strategies for reinforcing cardiac cycle for first year medical students, applying context of murmur timing. **MATERIALS AND METHODS:** Group 1 was Small group activity with simulator manikin exposure, group 2 was small group activity, group 3 was didactic lecture. Assessment involved MCQ test followed by a 2 trial simulator test. Before simulator test, group 2 and 3 also underwent simulation. **RESULTS:** Compared to group 3 significantly higher MCQ scores were observed in Group 1 and 2 ($P = 0.001$) with no significant difference between Group 1 and 2 ($P = 0.26$). In simulator test, mean successful trail number of group 1 and 2 was significantly higher ($P < 0.001$). **CONCLUSION:** When compared to didactic teaching, small group activity led to significantly better knowledge of cardiac cycle and better ability to narrow down differential for valve defect in simulator test.

The nearly doctors and how they can inform anatomy education

C. F. SMITH, C. LUSCOMBE, and J. ATLEY
Medical Education Department, Brighton and Sussex Medical School, University of Sussex, England

INTRODUCTION: Too often educators seek feedback from the immediate cohort or those who have just experienced the module. Whilst such feedback is vital to make adjustments that improve learning experience it perhaps misses out on the longer term wealth of how the anatomy course fitted into the wider program. **MATERIALS AND METHODS**: In 2018, Year 3–5 (N = 164) medical students were asked to rank the 156 learning outcomes (LO) in the Core Regional Anatomy Syllabus (CRAS) as: essential, important, acceptable and not required. In 2019, final year students were asked in a survey how they had relearned anatomy (N = 34). **RESULTS:** Year 5 students perceived a higher proportion of the LO as 'essential', except for head and neck and vertebral column. The main reasons students gave for ranking an area low was lack of clinical exposure or teaching time devoted to the topic. Students were asked to estimate the percentage of LO they felt they knew, 70.3% felt then knew at least 50% of the LO. Only 46% felt they knew more than 50% of LOs. Perhaps of concern is the 29.6% of students who felt they knew less than 50% of the CRAS. Thirty three percent of final year students reported that laboratory based sessions were the most effective method, closely followed by 23% saying they found tutorials the most effective, followed by lectures and self-directed study equally rated by 17% of students. **CONCLUSION:** There is a need for laboratory small group focused revisions sessions in later years of medical education.

"Flipped" vs traditional anatomy lectures to deliver content using anatomical principles: Quantitative and qualitative student outcomes

R. A. GREEN[1], H. A. Al-AUBAIDY[2], L. Y. WHITBURN[2], A. C. SILVESTER[2], and D. L. HUGHES[1]
[1]Department of Pharmacy & Biomedical Sciences, La Trobe University, Bendigo; [2]Department of Physiology, Anatomy & Microbiology, La Trobe University, Melbourne

INTRODUCTION: Flipped models of delivery are purported to have better learning outcomes. This study aimed to quantify the potential benefits of replacing traditional lectures with a flipped classroom model incorporating 'interactive sessions' and explore student perceptions about both formats. **MATERIALS AND METHODS**: In 2019, 8 of the 10 face-to-face lectures were replaced with interactive sessions during which students completed successive tasks relating to an

anatomical region (e.g., pelvis), previously presented via online videos, in the context of generalized anatomical principles (e.g., anatomical spaces have boundaries, openings and contents). Students engaged in frequent small-team discussion to complete tasks and reported back to the whole cohort. The final activity involved application to a practice examination question. Students completed post-class and end of semester surveys including open-ended comments. Student grades and feedback were compared with the previous year. Qualitative data was evaluated using content and thematic analysis. **RESULTS:** Students performed better on in-semester practical tests completed immediately after an interactive session ($P < 0.05$) but there was no difference for tests in a later week or end of semester examination. Compared with the traditional lectures that were retained in the subject, students found the interactive sessions more useful for improving knowledge and their preferred delivery mode (>85%). Compared with 2018, qualitative findings revealed a strong preference for interactive sessions, students finding these more engaging, more helpful in consolidating their understanding and encouraging a more active learning approach. **CONCLUSION:** Interactive sessions are more engaging, preferred by students when compared with traditional lectures and may improve grades.

Perceptions of an undergraduate anatomy near-peer mentor program

L. J. WHITE and H. W. MCGOWAN
La Trobe University, Melbourne, Victoria, Australia

INTRODUCTION: Near-peer mentor programs involve embedding of high-achieving third-year anatomy students within anatomy practical classes to assist teaching staff, answer student questions, and facilitate discussion. Such programs have significant benefits for Students, Mentors and Staff, however no study has assessed the opinions of all three groups within the same teaching period. **MATERIALS AND METHODS:** Students, Mentors and Staff involved in the 2019 Semester 1 undergraduate subjects Human Anatomy A & B were invited to complete anonymous surveys relevant to their cohort. Each survey contained open-ended questions about the best aspects of the program, areas for improvement, and the types and level of training mentors should receive. Responses underwent content analysis to identify key themes. **RESULTS:** Forty-seven Students (14%), ten Mentors (63%) and six Staff (50%) responded to the survey. Feedback regarding the near-peer mentor program was overwhelmingly positive. All cohorts identified the cognitive congruence between the mentors and students as a key strength of the program. Cohort-specific feedback included Students appreciating the social congruence and study tips offered by Mentors, the Mentors enjoying the revision of the anatomy content and development of teaching skill, and Staff like the improved staff-student ratios. However, all cohorts identified Mentor training as a key area for improvement. **CONCLUSION:** All cohorts highly valued the near-peer mentor program experience. Additional training for near-peer mentors should be provided in the future, particularly in relation to classroom management and teaching style, and content-specific revision sessions should be provided for Mentors before each practical class.

Reproducing 3D printed models for anatomical education: A feasibility study

N. MATTHEWS and M. DAYAL
Western Sydney University, Sydney, Australia

INTRODUCTION: The use of 3D printed models promotes kinaesthetic learning in anatomical education and allows students to examine fragile structures and even take the models home. A feasibility study was conducted on the resources required for reproducing a 3D printed anatomical model from human cadaveric material. **MATERIALS AND METHODS:** Bilateral dissections of the knee joint were performed. Both legs were separated from the knee joint line to allow for scanning of the femoral and tibial articulating surfaces separately. The dissected knee joints were scanned with the Artec Spider. The scanned data was processed, exported into a. STL file format, and 3D printed using a MakerBot® printer. During the process the required resources and time were recorded to produce an estimate of the total cost of the project. **RESULTS:** The extrinsic and intrinsic ligaments of the knee were exposed. In the left knee the anterior cruciate ligament was observed to be hypoplastic. The time taken to dissect each knee ranged from 17 to 25 hours, while the scanning of each articulating surface ranged from 1–2 hours. An analysis of the resource requirements was performed at the end of the project. **CONCLUSION:** Better understanding of the time, resources and funding required for reproducing anatomical structures using 3D printing should allow for educational institutions to plan and budget for using the technology. Use of 3D printing presents new challenges around adoption and implementation of new technologies, as well as ethical considerations concerning the appropriate use and storage of digital images of donor cadavers.

Persistent median artery and its anatomical relevance: A meta-analysis

J. R. PĘKALA[1,2], P. A. PĘKALA[1,2], B. SOLEWSKI[1,2], M. LIS[1,2], P. PASIEKA[1,2], M. P. PAZIEWSKI[1,2], K. A. TOMASZEWSKI[1,2], and M. KOZIEJ[2]
[1]Jagiellonian University Medical College, The International Evidence-Based Anatomy Working Group; [2]Jagiellonian University Medical College, Department of Anatomy, Poland

INTRODUCTION: Persistent median artery (PMA) might develop to be the main blood supply of median nerve and adjacent structures of the forearm. Due to high risk of complications associated with the

artery during operations performed on the carpal tunnel, PMA is especially important for orthopaedic surgeon. To conduct meta-analysis assessing the anatomical characteristics and clinical relevance of the persistent median artery. **MATERIALS AND METHODS:** Search through major medical databases was conducted. No date or language-based exclusions were applied. The assessment (with respect of AQUA rules) and extraction of data was performed independently by two reviewers. Statistical analysis was performed with usage of MetaXL 5.0 software. **RESULTS:** Seventy one studies (total of 12,082 limbs) were included in the analysis. The overall pooled prevalence equalled 9.4% (95% CI. 7.2–12.0). The PMA were more commonly found in cadaveric studies (9.2%; 95% CI: 6.9–11.8) compared to radiologic (6.7% 95% CI: 3.7–10.6) and ultrasonographic (7.2%; 95% CI: 3.7–11.7) studies. Interestingly, in 3 papers assessing infants the prevalence was 34.6% (95% CI: 5.5–70.7), significantly higher than among adults (8.6% (95% CI: 6.6–10.8). **CONCLUSION:** Our study indicates that PMA is relatively common structure among general population, being prevalent in nearly a tenth of the patients. Given its clinical significance and high risk of complications associated with damage of the artery, it should always be kept in mind while performing surgeries on the carpal tunnel.

How prevalent is infrapatellar synovial fold?

P. PASIEKA[1,2], P. A. PĘKALA[1,2], J. R. PĘKALA[1,2], M. PAZIEWSKI[1,2], M. MANN[1,2], and K. A. TOMASZEWSKI[1,2]

[1]Jagiellonian University Medical College, The International Evidence-Based Anatomy Working Group; [2]Jagiellonian University Medical College, Department of Anatomy, Poland

INTRODUCTION: The infrapatellar synovial fold, better known as ligamentum mucosum (LM), may rarely be one of the reasons of knee pain. Its anatomical properties and prevalence have not been thoroughly examined. In this study we intended to conduct meta-analysis summing up the advancements in anatomical description of LM. **MATERIALS AND METHODS:** Major medical databases were searched to identify all relevant articles. The data were extracted and statistically analysed. The PRISMA guidelines were strictly adhered to during our research. **RESULTS:** Nineteen studies comprising data from total of 2,700 lower limbs were enrolled. LM was present 64.5% (95% CI 48.9–78.9) of the time. The prevalence among females and males was the same (86.2 and 84.6), as between right and left side (94.7 and 92.2). The LM's prevalence was 27.7% (95%CI 11.0–48.0)] in radiologic studies, 65.1% (95%CI 42.4–85.1) in arthroscopic studies and 90.5% (95%CI 74.0–99.0) in cadaveric studies. LM was present in 63.2 (95%CI 44.4–80.3) of knees examined in European studies 88.4% (95%CI 81.3–94.0) in Asian ones, 63.2 (95%CI 44.4–80.3) and 29.2% (95%CI 5.1–60.6) in studies from North America. The most common type of LM was separate one - 70.5% (95%CI 60.8–79.1) of lower limbs. **CONCLUSION:** Our study confirms that LM is highly prevalent structure. Surgeons should always pay attention to that structure while operating in the area.

The prevalence and geographical distribution of the fabellofibular ligament: A meta-analysis

M. P. PAZIEWSKI[1], P. A. PĘKALA[1], J. R. PĘKALA[1], M. MANN[1], A. BAGINSKI[1], P. M. PASIEKA[1], K. A. TOMASZEWSKI[1, 2], and J. A. WALOCHA[1]

[1]Jagiellonian University Medical College, The international Evidence-Based Anatomy Working Group, Kraków, Poland; [2]Andrzej Frycz Modrzewski Kraków University, AFMKU, Department of Orthopaedics Trauma Surgery and Rehabilitation, Kraków, Poland

INTRODUCTION: The fabellofibular ligament (FFL) is a part of the arcuate complex, or posterolateral corner (PLC) alongside the arcuate ligament (AL) and the popliteofibular ligament (PFL). Its injury is associated with high morbidity and is frequently accompanied with damage to the cruciate ligaments and menisci. The aim of our study was to evaluate the prevalence of FFL in overall population, its geographical distribution and compare it in cadaveric and radiologic studies. **MATERIALS AND METHODS:** Two independent reviewers were conducting an extensive search through the major medical databases to identify relevant studies and assess their eligibility. Subsequently, the data extraction and statistical analysis were conducted. Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines were utilized to ensure the high quality of this study. **RESULTS**: Twenty four studies (total of 1,129 limbs) were enrolled in the analysis. The prevalence of absence of FFL equalled 49.3 (95%CI: 34.3–64.4) in overall population as well as 43.9% (95%CI: 27.3–61.2) and 62.4% (95%CI: 27.8–91.8) in cadaveric and MRI studies respectively. In North American studies, the FFL was absent in 48.4% (95% CI 13.2–84.4) of the limbs, compared to 73.3% (55.6–88.0) in European studies and 33.2% (18.4–49.7). Heterogeneity, measured by I-square test, was high for all studies. **CONCLUSION:** Our study shows that FFL is highly prevalent structure present in roughly half of general population. The analysis was characterized by high heterogeneity, so more studies with high quality methodology might turn useful to obtain clearer picture of the issue.

A reappraisal of the thoracoscopic anatomy for palmar hyperhidrosis

L. LAZARUS[1], J. NAIDOO[1], and B. SINGH2

[1]Discipline of Clinical Anatomy, University of KwaZulu-Natal, Durban, KwaZulu-Natal, South Africa; [2]Department of Surgery, University of KwaZulu-Natal, Durban, KwaZulu-Natal, South Africa

INTRODUCTION: Palmar hyperhidrosis is an idiopathic disorder characterized by excessive sweating of the hands. Traditionally, T2 ganglion is pivotal for upper limb sympathectomy. Recently, surgeons have implemented successful ganglionectomies for the treatment of palmar hyperhidrosis further down the sympathetic chain, specifically with the removal of the T3 or T4 ganglion. This review aimed to examine the literature from the turn of the century, with regard to the anatomical conundrum of extended ganglionectomies

undertaken for with special focus on T3 and T4 ganglionectomies. **MATERIALS AND METHODS:** A review for literature on patients who underwent T3 and T4 sympathectomies for palmar hyperhidrosis exclusively was conducted. Relevant studies from the current century were identified. Databases of Google Scholar, Ebsco Host and ScienceDirect libraries were searched. The study selection was guided by eligibility criteria. A data table was designed to extract information from the literature. The result of this study was reported using the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA). The quality of the included studies was assessed using the Mixed Method Appraisal Tool (MMAT). **RESULTS:** Twenty-two studies met the inclusion criteria- number of patients ranged from 20 to 322. All studies reported some degree of compensatory hyperhidrosis following the procedure. The total number of patients that reported a recurrence of symptoms ranged from 1–16. **CONCLUSION:** It can be concluded that T3 and T4 ganglionectomies achieve good curative effects for patients with PH with low postoperative complications globally. Compensatory hyperhidrosis remains as the most common complication when performing ganglionectomies of the sympathetic chain.

Mapping the ossification of the sternum in a contemporary Queensland pediatric population using computed tomography

C. A. BELL, M. S REYNOLDS, and L. S. GREGORY
Clinical Anatomy and Pediatric Imaging Research Laboratory, School of Biomedical Sciences, Faculty of Health, Queensland University of Technology, Brisbane, Australia

INTRODUCTION: The pattern of ossification of the sternum is complex and results in multiple variations in the morphology of the sternum. We aimed to investigate the volumetric development and timing of ossification of the sternum in a Queensland sample. **MATERIALS AND METHODS:** Retrospective multi-slice CT scans of the thorax from children aged 0 to 24 years (n = 97; 33 females and 64 males) were collected from the Queensland Health Enterprise PACS database. A new scoring system was developed to map the morphological stages of ossification for the manubrium and first-fourth sternal bodies. The ossification stage was scored using multiplanar formatting views and the volume of each sternal center was calculated by measuring regions of interest in serial sagittal or coronal slices in Osirix. **RESULTS:** The ossification and fusion of the primary centers followed previously reported patterns, with variation in the number of centers in the second to fourth sternal bodies (two centers in 94.6%, 82.8%, 80%, respectively). In girls and boys, the earliest age fusion was complete between the third and fourth sternebrae (first centers to fuse) was 3 and 7 years, respectively; and complete at the manubriosternal joint (last centers to fuse) at 16 and 18 years, respectively. The total volume of bone had a significant sex interaction with age (P = 0.005) where males had a greater velocity of volume increase with age than females. **CONCLUSION:** We present for the first time the timings and pattern of ossification of the sternum in an Australian pediatric population through qualitative and quantitative analysis.

Clinically important sectional anatomy of the medial intermuscular septum of the foot

G. K. BRUECHERT[1], C. G. THORPE LOWIS[2], W. H. B. EDWARDS[2], and Q. A. FOGG[1]
[1]*University of Melbourne, Melbourne, Australia;* [2]*Epworth Hospital, Melbourne, Australia*

INTRODUCTION: Lateral to the proximal belly of the abductor hallucis muscle (ABHm), the medial plantar septum is suggested to separate the plantar intrinsic muscles into compartments. It is not clear where this tissue originates proximally or with what structures it is associated along its course. The accuracy of techniques used in the literature vary greatly, making comparisons difficult. The present study aimed to assess the spatial relationship the medial intermuscular septum with surrounding tissues using cross-sectional and three-dimensional (3D) techniques that are quantifiable and reproducible. **MATERIALS AND METHODS:** The medial plantar septum was analysed within cadaveric specimens (n = 10). Cross-sections were carried out on −80°C frozen feet, from the hindfoot to the midfoot to assess the spatial relationships of the medial plantar septum. These relationships were further validated with dissection and 3D modeling of the medial plantar septum and surrounding tissues and neurovasculature using a microscribe digitiser. The thickness of the medial plantar septum was measured along its course. **RESULTS:** The medial plantar septum was much thicker than previously understood. It was identified to have a close spatial relationship with the flexor digitorum longus and flexor hallucis longus tendons and their tendinous sheaths, the medial plantar neurovasculature structures, intrinsic foot muscles, and the plantar aponeurosis. **CONCLUSION:** The medial plantar septum is thicker and has closer neurovascular relations than previously described. It may therefore contribute to plantar compartment syndromes and other hind/mid-foot disorders. This thick fibrous tissue may need to be considered as in the course of clinical management for these conditions.

Attachments to the hallucal sesamoids: A sectional anatomy and sheet plastination study

C. THORPE LOWIS, G. BRUECHERT, W. EDWARDS, Q. FOGG
University of Melbourne, Melbourne, Australia, Epworth Hospital, Melbourne, Australia

INTRODUCTION: The attachments of muscles to the sesamoids are of clinical interest in soft tissue releases in hallux valgus (HV) surgery. However, investigating through dissection is inherently disruptive and subjective; observation of the anatomy via sectioning may allow for validation of previous data and may reveal further interactions lost

during the dissection process. This study therefore aims to detail soft tissue attachments to the hallucal sesamoids in a series of sections. **MATERIALS AND METHODS:** Embalmed feet (n = 10) were frozen at −80°C and cut using a bandsaw (6 TPI, 6 mm) to a slice thickness of 1–1.5 mm. The slices were cleaned in -80C Acetone and carefully stored for scanning. Further foot slices were further processed for E12 sheet plastination, by dehydrating them in consecutively increasing concentrations of -80C acetone and impregnating them in resin before curing between two sheets of acetate. Additional components of select slices were further selected for histology and stained with a modified Masson's trichrome. An optical scanner (CanoScan Lide 400, Canon, Ota, Tokyo, Japan) was used to scan the slices at a resolution of 2400dpi. **RESULTS:** A clearer observation of the connections between the tendino-ligamentous complexes and the medial and lateral sesamoids was made. The extent of fibrous connections to the sesamoids was greater than previously described, effectively engaging with the entirety of each non-articular sesamoidal surface. **CONCLUSION:** The degree of connectivity of the hallucal sesamoids is complex. This study provided further levels of evidence for the differences found between the literature and the authors' findings.

Anatomical variations of the main septum of the sphenoidal sinus and its importance during transsphenoidal approaches to the sella turcica

M. P. ZARZECKI[1], J. JAWOREK-TROĆ[1], K. KRUPA[1], P. ŻMUDA[2], J. J. ZARZECKI[3], and J. A. WALOCHA[1]

[1]Department of Anatomy, Jagiellonian University Medical College, 12 Kopernika St., 31–034 Kraków, Poland; [2]University of Pavia, 27,100 Pavia, Italy; [3]Medical University of Silesia, 40–752 Katowice, Poland

INTRODUCTION: The following study aimed to examine the height of the main septum (MS) in the sphenoidal sinuses, as well as its type (bony, membranous or mixed) and its course amongst the adult Polish population. **MATERIALS AND METHODS:** A retrospective analysis of 296 computed tomography (CT) images (147 females, 149 males) of the paranasal sinuses was conducted. Transverse, frontal, and sagittal planes were visualized and analysed. **RESULTS:** The average height of the MS was 2.1 ± 0.41 cm for the entire research group. Completely bony MS was found in 32.8% of the patients, partially membranous in 63.9%, and solely membranous in 3.38% of the patients. The course of the MS changed the most often from the anterior to the posterior section of the sinuses (83.8%). The MS had the shape of the letter 'C' in 22.3% of the cases (typical in 11.8% and inverted in 10.5%). The rarest was the MS that resembled the letter 'S', which only appeared in 11.5% of the patients (typical in 5.74% and inverted in 5.74%). Only 16.2% of the patients had the MS that shifted neither its course nor its shape. **CONCLUSION:** In furtherance of reducing the risk of problems occurring during a surgery in the paranasal sinuses, it is prudent to have a CT performed in all the patients beforehand, due to the high prevalence of the anatomical variations in the sinuses.

Time to bury the radial collateral ligament of the wrist

Q.A. FOGG

Department of Anatomy and Neuroscience, the University of Melbourne, Melbourne, Australia

INTRODUCTION: The radial collateral ligament of the wrist has been a feature of anatomical texts for generations. It even appears in the occasional research paper. More detailed studies of the wrist ligaments, however, often exclude this ligament. Is this a terminological issue, or does the radial collateral ligament of the wrist even exist? This study aims to provide evidence to answer these questions. **MATERIALS AND METHODS:** Data from previous studies were collated, utilizing dissections of more than 400 donors. A small series of additional dissections (embalmed n = 8 and unembalmed n = 4) were also conducted. Dissections (previous and current) were completed under 6x magnification, using a fascicular method to trace individual fascicles along their full course. **RESULTS:** The radial margin of the wrist capsule does not include fascicular tissue that can be considered ligamentous. In about 20% of specimens a thickening of the capsule is observed along the radial margin, but this is non-fascicular and most likely a conduit for neurovasculature. Distinct ligamentous (fascicular) bands attached to the radial styloid process course both palmarly and dorsally into the wrist but were never observed to reinforce the radial margin. **CONCLUSION:** These data clearly confirm that there is no radial collateral ligament in the wrist. Whilst fibrous capsular tissue encloses this margin (and therefore can be fashioned into "ligament"), there is no evidence for a mechanically-important restraint in this area. The term should therefore be removed from use at all levels.

Age related lumbar trabecular bones in a Thai population

P. SATTARATH, K. WATTANAJITTIKUL, S. PRASITWATTANASEREE, J. SETTAKORN, and K. MEKJAIDEE

Chiang Mai university, Chiang Mai, Thailand

INTRODUCTION: Among all vertebrae, lumbar part is most tough and usually left behind in severely burned body. These vertebrae were reported as useful tool for age estimation in European. As it is known that application on different ancestry needs different methods and variables, studying in Thai is needed for Thai individual identification. The aim of this study was to investigate lumbar vertebrae of which the percentage of trabecular bone area over total area (%TBA/TA) correlates to age of individual. **MATERIALS AND METHODS:** Each lumbar body from level 1–5 (L1-L5) was drilled out from 21 Thai cadavers, aged more than 20 years old. After undergoing histological process every slide was photo taken. Then the images were loaded up on Matrix laboratory program (MatLab) to calculate for the percentage of trabecular bone area over total area (%TBA/TA). **RESULTS:** The % TBA/TA of L4 related very well to age of individual, both in women and men, and of L2 related well only in male group. **CONCLUSION:** The percentage of trabecular bone area over total area (%TBA/TA)

was investigated in 21 Thai cadavers, using photograph images and MatLab program. It was found that L2 and L4 were correlated well in males whereas L4 correlated well only in females.

3D ORGANON ORAL PRESENTATIONS – SESSION 3

Automated formative assessments are associated to successful academic outcomes among first year anatomy students

B. I. R. de OLIVEIRA[1], L. NG[1], A. FURNESS[1], J. P. OWENS[1], A. JACQUES[1] and M. TRAVERS[1,2]
[1]*Curtin University, Perth, Australia,* [2]*The University of Notre Dame, Fremantle, Australia*

INTRODUCTION: Formative assessments can be useful in motivating student academic success through feedback and can be particularly helpful for first year anatomy students. However, this is often precluded by large student numbers. In order to enable formative assessments to large student numbers, an automated assessment system was utilized. The main aims were to assess if automated formative scores were associated to improve summative scores and if they could be used to predict academic outcomes among first year anatomy students. **MATERIAL AND METHODS:** A quasi-experimental study assessed 220 students enrolled in an anatomy course over six time points: formative assessments 1 (FAx 1) and 2 (FAx2) before the Mid-semester summative assessment, and formative assessments 3 (FAx 3) and 4 (FAx4) before the Final summative assessment. Linear models were used to analyse if formative scores were associated with summative scores to predict academic outcomes. **RESULTS:** Mean Mid-semester scores ($\bar{x}$=60.3%) improved by 28.7% and 21% compared to FAx1 ($\bar{x}$ =31.6%) and FAx2 ($\bar{x}$ =39.3%). FAx1 and FAx2 scores were moderately-to-strongly correlated with Mid-semester scores (FAx1: r = 0.710, P < 0.001; FAx2: 0.682, P < 0.001). Mean Final scores ($\bar{x}$ =70.3%) also improved by 34.0% and 30.0% compared to FAx3 ($\bar{x}$ =36.3%) and FAx4 ($\bar{x}$=39.5%). FAx3 and FAx4 were also moderately-to-strongly correlated to Final scores (FAx3: r = 0.706, P < 0.001; FAx4: r = 0.719, P < 0.001). **CONCLUSION:** Students performed progressively better on automated formative assessments in the lead-up to automated summative assessments and formative scores can be used to predict academic outcomes among a large number of first year anatomy students.

Analysis of an undergraduate anatomy near-peer mentor program

L. J. WHITE[1] and H. W. McGOWAN[1]
[1]*La Trobe University, Melbourne, Victoria, Australia*

INTRODUCTION: Near-peer mentor programs involve embedding high-achieving third-year students within anatomy classes to assist staff, answer student queries, and facilitate discussion. Such programs have significant benefits for undergraduate Students, Mentors and Staff. **MATERIALS AND METHODS:** Students, Mentors and Staff involved in the 2019 Semester 1 subjects Human Anatomy A & B were invited to complete anonymous surveys relevant to their cohort. Surveys contained multiple 5-point Likert scale questions about the program and results were analysed by percent agreement and mean ± standard error of the mean (SEM). **RESULTS:** Ninety three percent of students indicated that they regularly interacted with Mentors. Over 95% of students felt that Mentors were knowledgeable, improved their understanding, and benefited their learning. Over 80% of students indicated that Mentors provided motivation to do well, helped improve marks, made studying more enjoyable, and made them feel more supported. Interestingly, 65% of students preferred to ask questions of Staff than Mentors, while 74% felt that they learn more from Staff than from Mentors. This is despite 100% of Mentors and Staff feeling that Mentors are helpful to students, and 89% of Mentors believing that students trust their knowledge. Nevertheless, 55% of Mentors and 50% of staff feel that Mentors needed more training. **CONCLUSION:** Students value the near-peer mentor experience very highly. However, while nearly all students found the Mentors to be both beneficial and knowledgeable on the subject content, most trust Staff more than Mentors. Results indicate that additional training could be undertaken to enhance Mentor-Student interactions.

Handmade models for gross anatomy: An innovative small group teaching tool for better understanding

N. KANASKAR, P. SONJE, and P. VATSALASWAMY
Dr. D. Y. Patil Medical College, Pune, Maharashtra, India

INTRODUCTION: Anatomy is a subject essential to medical practice, yet time committed to teaching is on the decline, and resources required to teach anatomy are costly, particularly dissection. Keeping this in mind an attempt was made to teach different gross anatomy topics in dissection hall in small group with the help of handmade models. Advances in technology are a potential solution to the problem, while maintaining the quality of teaching required for eventual clinical application. **MATERIALS AND METHODS:** Raw materials like cardboard, straws, color paper strips, synthetic threads, chart papers, plastic sheets, electric wires etc. were used to make different models like that of axillary artery with brachial plexus, middle ear, larynx, parotid gland, submandibular region etc. were used during dissection period among group of first MBBS students to make that particular region more easy to correlate and understand. **RESULTS**: Feedback questionnaire forms regarding usefulness of model in understanding the gross anatomy topic were taken by students which included utility, orientation of topic, correlation of the topic and most important whether complexity of topic was made easy or not. **CONCLUSION:** More and more active participation of students was seen to get along with topic with easy understanding and better grasping.

Large numbers of queries were also solved related to topic. Overall response of pupil was positive for learning tough gross anatomy topics via handmade models.

Near peer teaching in first year anatomy: differences between students' learning behavior and feedback responses

H. L. ANSCOMB
College of Medicine and Dentistry, James Cook University, Townsville, QLD, Australia

INTRODUCTION: An increasing number of undergraduate courses use near-peer programs to both teach and support first year students in the delivery of complex topics and to improve student engagement and retention. A near-peer teacher (NPT) is at a similar stage of training to the learner, but more advanced and benefits to the learner have been widely reported. Successful studies of NPT have reported that cognitive and social congruence between NPTs and the learners results in an overall more positive learner experience. **MATERIALS AND METHODS:** This study looked at the attitudes and perceptions of the student experience in a first year human anatomy subject when taught by junior faculty (academic B), senior faculty (academic D) and NPT (postgraduate student). Additionally, the students' learning behaviors for each teacher were obtained and analysed through a learning analytics program. All teaching material was standardized. A total of 80 students participated. **RESULTS**: The rating for overall teaching quality was high (mean = 4.4/5); students reported significantly higher levels of satisfaction from the NPT sessions ($p < 0.05$). Interestingly, this did not align with student learning behaviors, which demonstrated greater interaction with faculty content ($p < 0.05$ for D level). No significant difference in student learning outcomes was observed. **CONCLUSION**: Results from this study suggest that a student's perceptions of their NPT experience is not directly linked to their learning behaviors. This finding is important as many NPT and student engagement studies focus on a student's perceptions of the learning experience, whereas other factors may better influence student behavior.

Wot – no students! bringing anatomy students back into the lecture theatre with audience response systems

P. K. NICHOLLS
Murdoch University, Murdoch, Australia

INTRODUCTION: Lecturing in a sparsely populated venue reflects the zeitgeist of modern academia. Recorded lectures abound, but lecture theatres remain to puzzle us over how best to use them. How might we best retain social and educational aspects of learning together in our teaching? Free from custom hardware, anonymous audience response software, in synergy with students' own devices, creates different opportunities to engage within "heirloom" lecturing infrastructure. **MATERIALS AND METHODS:** Socrative apps or web interfaces were used in an unstructured approach to explore formats of engagement for the teaching of anatomy and histology. **RESULTS:** Students engaged well with synchronous modes of anonymous formative testing whether as pre-lecture diagnostics, end-of-lecture reviews, in Q&A sessions, or as a flipped classroom. Lecture recordings were used as the online resource prior to flipped sessions. Standard lecture theatres were used, in addition to smaller tutorial rooms. Asynchronous engagement, in which students used the quizzes at a time of their own choosing, outside the lecture theatre, was a further emergent mode. **CONCLUSION:** Anonymous quiz feedback before or during a face-to-face session can assist lecturers in tailoring their emphasis to the students' abilities, in real time. Live anonymized quizzes may be useful not only for a student's personal benchmarking or motivation, or even to satisfy their competitive instincts, but also to help construct a picture of the educational diversity amongst their peers. Such knowledge may help build a sympathetic understanding of the needs of their cohort, and of the challenges facing those involved in their education.

Microanatomy of human stenotic valves: The influence of intravalvular microhaemorrhages and neovascularization on M2 macrophage polarization

M. LIS[1,4,5], B. SOLEWSKI[1,4,5], J. CHRZANOWSKI[1,4], E. JASEK-GAJDA[1], U. CZUBEK[2], M. K. HOŁDA[5], B. KAPELAK[3], J. A. LITWIN[1], and G. J. LIS[1]
[1]Department of Histology, Jagiellonian University Medical College, Krakow, Poland; [2]Department of Coronary Disease, John Paul II Hospital, Jagiellonian University Medical College, Krakow, Poland; [3]Department of Cardiovascular Surgery and Transplantology, John Paul II Hospital, Jagiellonian University Medical College, Krakow, Poland; [4]Faculty of Medicine, Jagiellonian University Medical College, Krakow, Poland; [5]Department of Anatomy, Jagiellonian University Medical College, Krakow, Poland

INTRODUCTION: The microstructure of the aortic valve during the process of calcific degeneration is greatly affected by macrophages. M2 "anti-inflammatory" macrophages are well recognized in atherosclerotic lesions, yet their participation in aortic valve calcific degeneration remains unknown. We investigated the characteristics of the local milieu associated with the occurrence of the M2 macrophages in stenotic aortic valves. **MATERIALS AND METHODS:** Thirty four tricuspid stenotic aortic valves were obtained from patients (mean age 72.59 ± 6.19 years, 20 males, 14 females) undergoing valve replacement surgery. The valves underwent standard histological specimen preparation and staining (H&E). Histochemical and immunohistochemical stains were used to show microhemorrhages (Perls' and Mallory's phosphotungstic acid hematoxylin methods as well as glycophorin C identification), blood vessels (CD34) and overall macrophages (CD68). M2 macrophages were identified by co-expression

of CD163 and MMR (macrophage mannose receptor). They were examined under a scanning confocal microscope and evaluated using specialist software. Five healthy aortic valves were treated accordingly to serve as controls. **RESULTS**: M2 macrophages were found in 29 out of 34 (85.3%) valves. In 55% of valves, M2 macrophages formed large groups of concentrated cells. A higher incidence of M2 macrophages was associated with the occurrence of the intravalvular blood vessels and microhemorrhages ($P < 0.001$). The occurrence of M2 cells showed no statistical correlation with age and sex of subjects or with the level of structural valve degeneration. **CONCLUSION:** M2 macrophages are associated with neovascularization and intravalvular microhemorrhages but likely do not decelerate aortic valve calcific degeneration.

PRIMAL PICTURES ORAL PRESENTATIONS – SESSION 4

The effectiveness of concomitant use of cross-sectional anatomy and CT images in teaching anatomy to medical imaging students

J. AZIZ and J. THOROGOOD
School of Health Care and Social Practice, Unitec Institute of Technology, Auckland, New Zealand

INTRODUCTION: Cross-sectional anatomy helps medical imaging specialists during their education or after graduation to improve their skills in imaging interpretation. Aim: To determine the effectiveness of simultaneous use of cross-sectional anatomy and CT images in teaching anatomy to medical imaging students. **MATERIALS AND METHODS:** Fifty-eight students from the medical imaging program were included in this study. Students were divided into two groups: Group I (29) from the academic year 2017–2018 had been taught regional anatomy without concomitant use of CT images 1 year before the test, Group II (29) from the academic year 2018–2019 were studying sectional anatomy with concomitant use of CT images. The methodology consists of identifying anatomical structures displayed on plastinated sections available on online resource and its corresponding anatomical structures on computed tomography (CT) sections. Students were asked to identify ten anatomical structures on plastinated cross section and correlate these structures to its corresponding structures on CT images. **RESULTS:** The percentages of students in groups I and II who correctly identified the anatomical structures in the test were measured. The percentage of errors in-group II were much lower than the errors in-group I. Analysis of the results revealed a significant difference in test scores with scores of 89.7% and 65.5%, respectively. **CONCLUSION:** These results provide evidence that the implementation of the sectional anatomy as a tool in teaching anatomy becomes a crucial fact in medical imaging curricula and has a great impact on subsequent CT interpretation.

Evaluating the effectiveness of an online interactive histology resource

A. TROLLOPE, K. DOMETT, T. WOOLLEY, and A. GAVAN
James Cook University, Queensland, Australia

INTRODUCTION: Histology is a challenging subject for most students and especially first-year students. The James Cook University (JCU) Anatomy department developed an interactive, adaptive learning histology resource with embedded interactive videos and quizzes for first-year Biomedicine students accessible with any "smart" device. The histology resource was evaluated for flexibility, accessibility, effectiveness in engaging students, and perceptions of how the resource assisted student learning. **MATERIALS AND METHODS:** The histology resource was produced for first-year JCU Biomedicine students using Articulate 360 and embedded into the online student learning platform "LearnJCU". Individual chapters were created with slides showing tissues from a range of organs. Key areas in the tissue and cells were linked to a table of contents allowing students to navigate the histology resource for self-directed learning. End-of-semester data on the number of students who engaged with the different chapters and average time spent interacting with chapters were collected via LearnJCU, while student surveys were distributed in class and online. **RESULTS:** Of the 28 students who participated in the survey (response rate3 7%),93% agreed the histology resource assisted with their learning, 96% agreed the histology resource was at an appropriate level, and 93% agreed he histology resource was engaging. Student engagement with the different chapters ranged from 17–37% of the cohort, while individual time spent interacting with the histology resource ranged from 19–31 minutes. **CONCLUSION:** The online histology resource successfully engaged students, with the vast majority agreeing the resource was at an appropriate level, assisted with their learning, and was engaging.

Development and pilot testing of a novel ultrasound protocol for investigating chronic pain in trapezius

M. L. STIVER[1], A. M. R. AGUR[1], and S. A. MIRJALILI[2]
[1]University of Toronto, Toronto, Canada, [2]University of Auckland, Auckland, New Zealand

INTRODUCTION: Myofascial pain syndrome (MPS) is one of the most common causes of chronic pain worldwide. Ultrasound (US) offers a cost-effective solution for objectively assessing MPS; however, the application is inherently limited by a lack of standardized protocols based on volumetric musculoaponeurotic data. In this study, digitized cadaveric data from adult trapezius muscles were modeled in 3D and used to guide the development and testing of an in vivo US protocol. **MATERIALS AND METHODS:** Six cadaveric trapezius muscles were digitized and modeled in 3D (Autodesk® Maya®). Modeled data were registered onto a FaroArm®-scanned skeleton as a frame of reference for US protocol development. Using these models, we characterized

the spatial arrangement of the contractile tissues, connective tissues, and musculoaponeurotic junctions (MAJs). Regions of interest for each tissue type were identified and described in detail with respect to prominent bony landmarks. **RESULTS:** Guided by published patterns of pain in trapezius, we identified MAJs as the regions most commonly coincident with MPS throughout trapezius. For example, in the transverse partition of trapezius, a wedge-shaped band of connective tissue extended laterally from the spinous processes of C7–T3/4/5. This results in a broad triangular region of MAJ that can be imaged near the midpoint of the muscle belly. Pilot protocol testing is currently underway using the Siemens ACUSON™ S3000. **CONCLUSION:** Development of standardized US protocols is anticipated to provide crucial insights into the progression of disorders like MPS. Likewise, it will improve the effectiveness of US as a tool for diagnosis and assessment.

Between session reliability of intramuscular electromyography for segments of gluteus medius and minimus during gait and stepping tasks

R. A. GREEN[1,2], T. PIZZARI[2,3], J. MCCLELLAND[2,3], A. ZACHARIAS[1,2], P. HUYNH[4], N. WEERAKKODY[1,2], and A. I. SEMCIW[2,3]
[1]Department of Pharmacy & Biomedical Sciences, La Trobe University, Bendigo; [2]Sport, Exercise & Rehabilitation Research Focus Area, La Trobe University; [3]School of Allied Health, La Trobe University, Melbourne; [4]Department of Engineering, La Trobe University, Melbourne

INTRODUCTION: Between-session reliability of electromyographic data is important for confidence in interpreting the role of muscles in functional tasks but critical if these data are to be compared before and after an intervention that seeks to change pathological patterns of muscle activity. This re-test reliability, particularly for intramuscular electrodes, has been challenged in previous studies. The gluteus medius (GMed) and minimus (GMin) are known to have functionally discrete segments that are highly active during stance phase of gait and stepping tasks. This study aimed to measure the between-session reliability of activity patterns and any differences in mean amplitudes and time to peak (TTP) activity of these muscle segments during functional tasks. **METHODS:** Intramuscular electrodes were placed in three segments of GMed and two segments of GMin in 10 healthy young adults for each of two testing sessions held two weeks apart. Participants completed six repetitions of comfortable speed walking trials, step-up and step-down tasks with activity patterns for each muscle segment time- and amplitude-normalized and averaged across trials for each task. **RESULTS:** Re-test reliability was high for activity patterns (coefficient of mean correlation ranging from 0.890 to 0.998) across all tasks and muscle segments. There were no differences in TTP activity across all tasks and muscle segments and only two of 30 pairwise comparisons showed differences in mean amplitude between sessions. **CONCLUSION:** With standardized data collection and analysis procedures, GMed and GMin muscle segment activity patterns show good between-session reliability for weight bearing tasks.

POSTER PRESENTATIONS – SESSION 3

Pediatric regional anesthesia: A two-year retrospective analysis of procedures, techniques and clinician expertise

S. BYUN[1], D. SANDEMAN[2], B. SHULRUF[3], and N. PATHER[1]
[1]Department of Anatomy, School of Medical Sciences, Medicine, UNSW Sydney, Sydney, Australia; [2]Department of Anaesthesia, Sydney Children's Hospital Randwick, Sydney, Australia; [3]Medical Education, Medicine, UNSW Sydney, Sydney, Australia

INTRODUCTION: Pediatric regional anesthesia has become prevalent and effective in the management of pain in children. Technical and training guidelines however require review, to continue to provide the most reliable anesthetic procedures applicable to the range of ages in the pediatric population. This study aimed to assess the prevalence and effectiveness (outcome) of a pediatric regional anesthetic practice over a period of two years at one hospital site. **MATERIALS AND METHODS:** A total of 3,789 cases (2015–16) were selected from a medical record database of a Sydney's Children Hospital (LNR/16/SCHN/387). Information on patient demographics, operative and recovery data and the level of clinician expertise were analysed for frequency and significant relationships. **RESULTS:** Twenty types of regional blocks were reported (17% of 3,789). The majority of procedures were performed in the head and neck region (43% of 3,789) however, regional blocks of the trunks were related to longer duration of procedure and recovery. Younger patients required longer time to both induce (36.6 ± 22.1 mins) and recover from (76.5 ± 61.8 mins) anesthesia. Of the 3,789 case reports analysed, only 212 included details on the techniques used (e.g., ultrasound-guided or landmark palpation-based). Of note, only 22 recorded reasons for complications. The outcome of regional anesthesia negatively correlated with clinical experience level of anesthetists ($P < 0.05$). **CONCLUSION:** The absence of detailed notes in the medical reports and the significant negative correlation between outcome and clinical expertise suggest a need for improved technical and training guidelines for a more reliable anesthesia in children and infants.

Embryology made fascinating for undergraduate students through implementation of innovative teaching methods

P. SONJE, N. KANASKAR, and P. VATSALASWAMY
Dr D.Y. Patil Medical College, Pune, Maharashtra, India

INTRODUCTION: Embryology, one of the most important part of Anatomy, although interesting, first MBBS students find it difficult to understand because of different terminologies. To increase student's interest in the subject, different innovative teaching methods were implemented throughout the academic year 2018-19. Feedback was taken from students, which indicated the usefulness of the new

teaching methods. **MATERIALS AND METHODS**: Following innovative teaching methods were implemented for first MBBS students. 1. Self-directed learning (SDL) - Based on the teaching methods in medical education technology, certain topics were given to students to study on their own and were asked to present the same. Materials used-reference books of embryology, internet. 2. Embryology seminar by undergraduate students- embryology seminar by undergraduate students was organized on different topics. Materials used: embryology textbooks, videos, materials like clay, color tubes, color threads, drawing sheets, card board sheets for making embryology models. 3. Embryology workbook and changes in the journal were included as a part of teaching methodology. **RESULTS:** 1. SDL-Students made varied positive efforts for this activity. Seventy percent of the class participated in this exercise, gathered lots of information on the given topics and appreciated this newer method of teaching learning as it became an interactive session. 2. Seminar- Seminar brought out the creativity of the students as they made "Working Embryology Models" which made learning embryology easy and interesting. **CONCLUSION:** More and more interactive, thought provoking ideas and memory and recall methods were seen used by undergraduate students.

Team-teaching in a large first-year human anatomy subject: Student perceptions and learning outcomes

H. W. MCGOWAN[1], D. L. HUGHES[1], L. Y. WHITBURN[1], L. BIGGS[2] and A. C. MCDONALD[1]

[1]*La Trobe University, Department of Physiology, Anatomy and Microbiology, Victoria, Australia;* [2]*La Trobe University, Judith Lumley Centre, Victoria, Australia*

INTRODUCTION: Teaching anatomy to large numbers of first-year students (approx. 2,300) over multiple campuses has challenges. One major challenge is the diversity of teaching staff. Student Feedback on Subject (SFS) surveys indicated that student experiences differed due to perceptions of different teaching approaches. In 2018, to improve consistency, the large metropolitan campus (1,577 students and 31 staff) implemented a team-teaching approach to anatomy workshops (one Lead Demonstrator and one/two Demonstrators, teacher: student ratio of 1:20). The regional campuses remained sole-taught (one Lead Demonstrator for 25 students). This study aimed to compare students' impressions of team-taught vs sole-taught workshops, and student learning outcomes. **MATERIALS AND METHODS:** Student responses to surveys, student marks and SFS scores were collected. Analysis included t-tests for final marks, Mann–Whitney tests for Likert-scale responses, and thematic analysis for open-ended responses. **RESULTS:** Sole- and team-taught students were equally satisfied with the "overall quality of the subject" and final marks were not significantly different. Team-taught students felt they had to wait longer ($P < 0.001$) and received less support ($P < 0.05$) than sole-taught students. Comments from the team-taught campus, however, indicated a strong support for team-teaching. **CONCLUSION:** There is strong student support for team-teaching and no adverse effect on student marks or overall perception of the subject. Perceptions of increased wait time may relate to uncertainty from students about the classroom roles of all demonstrators. Team-teaching will be implemented at all campuses to ensure content consistency whilst supporting different learning styles by offering multiple staff perspectives.

The anatomical database

L. SALADO-VEGA and M. R. DAYAL

[1]*Western Sydney University, New South Wales, Australia*

INTRODUCTION: Resources that anatomy academics requests for "non-dissection" practical sessions include anatomical models (commercial and 3D printed), real bones and prosections for kinesthetic learning in the laboratory. In very large departments, where there are a number of different resources, keeping track can become difficult, especially when there is no communication tool between technical and academic staff. Thus, the use of databases is an easier way to manage communication. In this instance, a Microsoft Access Database was created as a usable working platform and accessible searching tool to allow academics to search and request resources for each lab. This database also serves as an inventory tool especially when resources like prosections are consistently being replaced. **MATERIALS AND METHODS:** University asset numbers and academic catalogue numbers were assigned to the models. To digitalize all models, images of the resources were taken and later edited to include the asset and catalogue numbers. Each resource was classified into an anatomical region: head and neck, neuro, thorax, abdomen, pelvis, musculoskeletal and miscellaneous. A secondary classification included organ systems such nervous, musculoskeletal, digestive, genitourinary, circulatory and respiratory. For models that did not fit into these categories other labels included anthropology, fetal development and miscellaneous. Each resource was then uploaded into the database. **RESULTS:** An anatomical database was created that is searchable by organ system, anatomical region, and key words. **CONCLUSION:** This easy-to-use tool avoids confusion and provides academics with an easier way to request learning material, whilst also providing an invaluable inventory tool.

Neuroanatomy education in Australian and New Zealand medical schools

H. J. NEWMAN[1,2], A. J. MEYER[1], and S. E. CARR[2]

[1]*School of Human Sciences, The University of Western Australia, Perth, Australia;* [2]*School of Allied Health, The University of Western Australia, Perth, Australia*

INTRODUCTION: Medical student knowledge of central and peripheral nervous system anatomy may be below an acceptable level. This

leads to lower confidence of junior doctors in managing neurological conditions and unsafe medical practice. To improve knowledge acquisition and retention, many innovative (largely digital) teaching techniques have been designed. There is no instructional curriculum for use of these tools, and it is up to the discretion of the academic for how they are applied. This study aims to assess the content, instruction and assessment of neuroanatomy in Australia and New Zealand medical schools. **MATERIALS AND METHODS:** An electronic survey was sent to 24 Australia and New Zealand medical schools. Academics were asked to comment on the course, content, instruction and assessment of neuroanatomy for the 2018 academic year. **RESULTS:** The majority (22/24, 91.7%) of medical schools responded. The average time dedicated to teaching neuroanatomy was 46.0 hours (±38.1) with a range of 12 h to 160 h. In regards to traditional teaching techniques, prosections (77%) and models (77%), were used by most universities. Dissection was utilized by 13/22 (59%) universities. Incorporation of new technologies was highly variable, the most common being 3D software (59%) and eBook (55%). Adoption of virtual reality technologies was low (36%). **CONCLUSION:** Methods of teaching neuroanatomy were highly variable between institutions. There is a need for an evidence-based instructional curriculum to better standardize the teaching of this important basic science. Future research may be conducted into examining whether this variable methodology leads to a difference in graduate student knowledge of neuroanatomy.

Fenestration of the intracranial vertebral artery and vertebrobasilar junction detected with multidetector computed tomography angiography

B. R. OMOTOSO[1], R. HARRICHANDPARSAD[2], J. NAIDOO[1], L. LAZARUS[1], and K. S. SATYAPAL[1]

[1]Department of Clinical Anatomy School of Laboratory Medicine and Medical Science, College of Health Sciences, University of KwaZulu-Natal, Westville Campus, Durban, South Africa; [2]Department of Neurosurgery, School of Clinical Medicine, College of Health Sciences, Nelson R Mandela School of Medicine University of KwaZulu-Natal, Durban, South Africa

INTRODUCTION: Fenestration of the vertebrobasilar artery is a rare congenital anomaly which are commonly reported on the extracranial component of the vertebral artery. Complex embryonic origin of the vertebral artery has resulted in a wide range of anatomical variations. Vascular fenestration has been associated with aneurysms, arteriovenous malformations, neuralgia and vertebrobasilar ischemia. **MATERIALS AND METHODS:** The design of this study was approved by our Institutional Review Board/Ethics Committee (Biomedical Research Ethics Committee of the University of KwaZulu-Natal with ethical No: BE 148/19). We report on three cases of vertebrobasilar artery fenestration in the intracranial segment of the artery; two at the vertebrobasilar junction and one right intracranial vertebral artery in two male and one female white South African respectively using multidetector computed tomography angiography. Two of the patients had a clinical history of transient ischemic attack while that of the third was a visual disturbance. **RESULTS:** The vertebral artery fenestration is 5.9 mm long while that of the vertebrobasilar junction is 3.9 mm and 5.9 mm long. In addition to fenestration in one of the cases with transient ischemic attack, there is hypoplasia of the right vertebral artery. **CONCLUSION:** Generally, an awareness of the vertebral artery variations is clinically important. This knowledge finds clinical application in diagnostic investigation and interpretation of the pathology of the vertebral artery on CT, MRI, angiographic and ultrasound investigations and treatment of vertebral artery pathology during surgical and endovascular procedures. In addition, fenestration at the vertebrobasilar junction can increase the incidence of vertebrobasilar junction aneurysm.

CT evaluation of the relationship between the sphenoid sinuses and the optic and carotid canals with their clinical implications

M. P. ZARZECKI[1], J. JAWOREK-TROĆ[1], K. KRUPA[1], P. ŻMUDA[2], J. J. ZARZECKI[3], J. A. WALOCHA[1], and K. A. TOMASZEWSKI[1]

[1]Department of Anatomy, Jagiellonian University Medical College, 12 Kopernika St., 31–034 Kraków, Poland; [2]University of Pavia, 27,100 Pavia, Italy; [3]Medical University of Silesia, 40–752 Katowice, Poland

INTRODUCTION: This study evaluated the frequency prevalence of the carotid canal's protrusion into the sphenoid sinuses, as well as incorporation of the sinuses' septum / septa in the wall of the carotid and optic canals. **MATERIALS AND METHODS:** Computed tomography (CT) scans of the paranasal sinuses of 296 patients (147 females, 149 males) were analysed in this retrospective study. The patients did not present any pathologies in the sinuses. Spiral CT scanner¬ was used in the standard procedure. No contrast medium was given to any of the patients. **RESULTS:** Protrusion of the carotid canal was found in the majority of the patients (55.7%), more frequently in males (65.1%) than females (46.26%). Bilateral incorporation of the main septum (MS) in the carotid canal was not present in any of the patients, whereas unilateral was noticed in 22.0%. Bilateral incorporation of additional septum (AS) in the carotid canal was found in 8.45%, whereas unilateral in 28.37%. Incorporation of two septa on the same side was noticed in 4.39%, and three septa in 0.34%. Bilateral incorporation of MS in the optic canal was found in 0.34%, and unilateral in 21.0%. There were not found any sphenoid sinuses that had more than two septa unilaterally incorporated in the optic canal. **CONCLUSION:** Complicated structure of the paranasal sinuses may perplex routine surgical interventions by for example, arterial bleeding difficult to stop in the sinus' narrow space or an injury to the optic nerve. Henceforth, careful anatomical consideration is crucial prior to any intervention within the sinuses.

Cerebral cortex cytokine changes in healthy ageing, motor neurone disease and Alzheimer's disease

A. TENNAKOON[1], V. KATHARESAN[1], I. MUSGRAVE[1], S. KOBLAR[1], R. FAULL[2], M. CURTIS[2], and I. JOHNSON[3]
[1]*The University of Adelaide, Australia;* [2]*The University of Auckland, New Zealand;* [3]*Macquarie University, Sydney, Australia*

INTRODUCTION: Increased levels of inflammatory cytokines have been associated with both neurodegeneration and neuroprotection in experimental studies. In order to clarify the contradictory roles of inflammation in neurodegenerative disorders, we have compared cytokine changes in healthy ageing, Motor Neurone Disease (MND) and Alzheimer's Disease (AD). **MATERIALS AND METHODS:** Six cytokines, IL-4, IL-5, IL-6, IL-10, FGF-2 and MIP-1α were analysed using multiplex technology in fresh-frozen frontal cortex samples (n = 12 per group) of MND patients (50-68y), AD patients (60-87y), ageing controls (43-89y) and young adult controls (19-35y). **RESULTS:** Levels of IL-10 and FGF-2 were lower in ageing controls compared to young adult controls (P = 0.01 and 0.008 respectively). IL-5, IL-6, IL-10 and FGF-2 levels were higher in MND cortices compared to ageing controls (P < 0.002 for all three cytokines), whereas IL-4, IL-5, and FGF-2 were higher in AD cortices compared to ageing controls (P < 0.001 for all 3 cytokines). **CONCLUSION:** We report that healthy ageing is associated with decreased anti-inflammatory cytokines in the brain, which is consistent with our ageing animal studies. Both AD and MND had increased brain cytokine levels, although the two diseases had different patterns of cytokine increase. IL-6 showed the most significant increase in MND whereas FGF-2 showed the most significant increase in AD. Modification of levels of specific brain cytokines may have therapeutic potential in neurodegenerative diseases such as MND and AD.

An anatomical study of the iliocapsularis muscle

A.WILLIAMS, N. A. M. S. FLACK, and S. J. WOODLEY
University of Otago, Dunedin, New Zealand

INTRODUCTION: Iliocapsularis is a small muscle that covers the anterior hip joint capsule. It has been implicated in hip dysfunction yet little is known about its detailed anatomy and it remains unclear whether it is separate to, or part of, iliacus. The aim of this study was to examine the morphology of iliocapsularis using macro- and microscopic anatomical approaches. **MATERIALS AND METHODS:** Twelve specimens (six embalmed cadavers, three females; mean age 70 ± 11.3 years) were examined using fascicular dissection. Footprint areas of attachment were quantified by 3D scanning technology. The nature of the capsular insertion was examined histologically and fiber type composition was determined using immunohistochemistry and stereology. **RESULTS:** No distinct fascial plane existed between iliocapsularis and iliacus. Mean total PCSA and fascicular length of iliocapsularis were 0.7 ± 0.2 cm^2 and 10.4 ± 1.0 cm, respectively. Its capsular attachment (2.9 ± 1.1 cm^2) was approximately three times larger than its bony footprints (proximal 1.2 ± 0.5 cm^2; distal 1.3 ± 0.7 cm^2), and 50% of the total length of the deep fascicles attached either directly to the capsule or via a layer of loose connective tissue. The innervation pattern of iliocapsularis was variable. The proportion of Type I to II fibers was similar within iliocapsularis (approximately 50% of each) and no different to iliacus. **CONCLUSION:** Although iliocapsularis has distinct attachment sites, it may be best defined as a part of iliacus given the lack of a separating fascial plane and similarities in fascicle length and fibre type.

Associations between physical activity and muscle size and strength: A systematic review with meta-analysis

Z. ROSTRON[1], R. A. GREEN[1], M. I. C. KINGSLEY[2], and A. ZACHARIAS[1]
[1]*Department of Pharmacy & Biomedical Sciences;* [2]*Department of Rural Allied Health, College of Science, Health and Engineering, La Trobe University, Bendigo, Victoria, Australia*

INTRODUCTION: Physical activity (PA) has been shown to have widespread benefits for both health and disease prevention. Rehabilitation programs use PA on the assumption that it leads to muscle hypertrophy and increased muscle strength. The aim of this systematic review was to determine whether there is a relationship between PA and each of lower limb muscular size and strength within the general population. **MATERIALS AND METHODS**: Literature searches were systematically completed using six databases and three main constructs; lower extremity, muscle volume and muscle strength. All included studies required measures of PA (measured either objectively or subjectively), lower limb muscular size and strength. All data were then re-calculated as standardized scores (z scores) using published age- and gender-normative values for each outcome measures for discrete groups in each included study. Pearsons correlation was used to evaluate the relationship between PA and each of muscle size and strength. **RESULTS:** After application of inclusion/exclusion criteria, 40 studies were included from an initial yield of 5,211 studies. Standardized scores were calculated for 89 discrete groups from these studies. Objectively measured PA (e.g., accelerometry) was strongly correlated with muscle size (r = 0.76) and had a weaker correlation with strength (r = 0.38), whereas subjectively measured PA (e.g., questionnaires) showed much weaker relationships (r = 0.09 for both size and strength). **CONCLUSION:** This review identified that objective measures of PA are better predictors of changes in muscle size and strength. Therefore, PA should be measured objectively to predict muscle changes associated with rehabilitation programs in clinical populations.

WOLFVISION ORAL PRESENTATIONS – SESSION 5

Imaging the collagen architecture in human finger joint capsules

R. G. COUTTS, F. R. SAUNDERS, R. M. ASPDEN, and F. GROENING
School of Medicine, Medical Sciences and Nutrition, University of Aberdeen, Aberdeen, UK

INTRODUCTION: Arthritic conditions affect 15 % of the UK population, with 6 % of people aged 45 and over being affected by hand osteoarthritis. Treatment often requires surgery and joint replacement. Joint replacement (arthroplasty) is effective for pain relief, but restoration of function is less successful than in larger joints. A common cause for post-surgical functional losses is connective tissue contracture; a permanent shortening that mostly occurs in a direction across the collagen fibers. Hence, it is important to establish collagen fiber orientation and use this information to guide surgical interventions. The study aimed to identify collagen orientation in the joint capsule and connective tissue surrounding the capsule. **MATERIALS AND METHODS:** Donated human cadaveric fingers (15) were dissected and the metacarpo-phalangeal as well as proximal and distal interphalangeal joints were cryosectioned and stained to visualize collagen fibers. Samples were examined using brightfield, polarized light, confocal and scanning electron, microscopy techniques. **RESULTS:** Images from the joint sections showed collagen fiber orientations predominantly with a proximal/distal direction. However, near the synovial membrane collagen fibers have multiple orientations when observed in a sagittal view. Multiple directions also exist in the palmar and dorsal menisci as seen by cut fiber ends. **CONCLUSION:** The multiple collagen fiber directions observed in the joint capsules could potentially affect tissue healing characteristics, and thus the outcomes of joint surgery.

Redefining wrist anatomy: Extra-capsular contributors to the ulnocarpal ligament complex

Q. A. FOGG
Department of Anatomy and Neuroscience, the University of Melbourne, Melbourne, Australia

INTRODUCTION: The arrangement of the ligaments of the wrist continues to be poorly understood. Anatomical complexity, technical difficulty and imprecise terminology have all contributed to restrict progress. This is most pronounced for the ulnocarpal ligament complex (UCLC). Reports range from the too basic to too abstract. Previous studies also fail to include neighboring structures, such as retinaculae and tendon sheaths, often removing these prior to looking for the structures of interest. This study aims to describe the ULC in relation to the complete anatomy of the ulnar side of the wrist. **MATERIALS AND METHODS:** Embalmed (n = 10) and unembalmed (n = 6) body donors were dissected under 6x magnification, using a fascicular method to trace individual fascicles along their full course. **RESULTS:** The extensor retinaculum is a principle contributor to the UCLC. It has prominent pisiform attachments, as will as thickening more deeply to form ulno-pisiform ligaments palmarly and ulnarly. The most ulnar fascicles of the piso-metacarpal ligament are continuous with the retinaculum. Ulno-triquetral and triquetro-hamate ligaments both have ulnar attachments that are continuous, in part, with the thickened floor of the extensor carpi ulnaris tendon sheath. **CONCLUSION:** These data suggest numerous prominent connections that were lost in previous studies due to the pre-emptive removal of the extensor retinaculum and tendon sheaths around the ulnar side of the wrist. With a more inclusive dissection, new relationships have been described which may alter the understanding of wrist function and inform revised approaches to the management of wrist dysfunction.

Estimating age from carpal ossification: does side matter?

I. MATAR[1], T. LUCAS[1], L. GREGORY[3], S. BYUN[1], S. MORRIS[2], and N. PATHER[1]
[1]Department of Anatomy, School of Medical Sciences, University of New South Wales, Sydney, NSW, 2052, Australia; [2]Department of medical imaging, Sydney Childrens Hospital, Randwick, NSW, Australia; [3]School of Biomedical sciences, Faculty of Health Sciences, Queensland University of Technology, Queensland, Australia

INTRODUCTION: Age estimation from radiographs is common in forensic, refugee and asylum seeker cases where age is found to be undocumented. The current methods used are outdated and not applicable to all populations due to population and secular variations in pediatric growth. This study aims to use the ossification of the carpus in a modern sample of New South Wales children to determine an age estimation formula and to establish whether the practice of using only left sides is warranted. **MATERIALS AND METHODS:** Hand x-rays (n = 400; 194 left and 206 right) from the Sydney Children's Hospital (aged birth to 17 years; n = 256 males and 144 females) were analysed. Bone area (BO) and carpal area (CA) were measured, and a carpus ossification ratio (BO/CA) was calculated for each individual. The age formula was generated using linear regression analysis. **RESULTS:** Analysis demonstrated no significant difference between left and right wrists sides in the ossification ratio (95% CI). Age = [−0.972 + 1.403 g + 21.758 (BO/CA)] ± 1.40. This regression formula accounted for 88% of total variance. The median of the absolute values of residual (MAR) and the standard error of estimate (SEE) were – 0.03 years, 1.40 years respectively. **CONCLUSION:** Using the ossification ratio of the carpus, an age estimation formula with a relatively high degree of reliability and accuracy was generated for a modern sample of New South Wales Children.

The revised structure and arrangement of the tarsal tunnel via sectional anatomy and 3D virtual modeling

G. K. BRUECHERT, C. G. THORPE LOWIS, W. H. B. EDWARDS, and Q. A. FOGG
University of Melbourne, Melbourne, Australia, Epworth Hospital, Melbourne, Australia

INTRODUCTION: The etiology of tarsal tunnel syndrome (TTS) is not always clear. This may be due to incomplete or inconsistent understanding of the anatomy of the tarsal tunnel (TT). Previous studies have only looked at one or few of the contents of the TT. Recent dissection-based studies have demonstrated this anatomy more clearly, but the necessarily subjective and destructive nature of this work needs further verification. The aim of the present study was to compare the anatomy of the TT through dissection and cross-sectional analysis in order to produce an accurate three-dimensional (3D) model of all contents of the TT. **MATERIALS AND METHODS:** Ten embalmed specimens were used. The spatial relationships of the TT contents were assessed via thin sections in multiple planes, and via dissection with 3D modeling. **RESULTS**: Both the floor and roof of the TT were fibrous and muscular, with muscle contributions from the quadratus plantae and abductor hallucis muscles. Within the TT, the neurovasculature had a close spatial relationship with the abductor hallucis muscle, the medial plantar septum, and the tendinous sheaths of the flexor digitorum longus and flexor hallucis longus tendons. **CONCLUSION**: The floor and roof of the TT are more muscular than previously suggested; expansion of this muscle may alter the potential volume of the TT. The neurovasculature of the TT may be compressed by multiple surrounding tissues. This revised anatomy of the TT will better inform clinical management of TTS.

3D micro-CT to demonstrate the detailed spatial arrangement of the nutrient foramina of the hallucal sesamoids

C. THORPE LOWIS, G. BRUECHERT, W. EDWARDS, and Q. A. FOGG
University of Melbourne, Melbourne, Australia, Epworth Hospital, Melbourne, Australia

INTRODUCTION: Occlusion or disruption of hallucal sesamoid vasculature are important in the etiology of conditions that affect the sesamoids, such as avascular necrosis. The vasculature of the sesamoids and their entry points have not been well established; the few previous studies lack detail, vessel size is not quantified, the intra-osseous path is not well identified and potential anastomoses are not recorded. This study aims to describe and measure these features in detail. **MATERIALS AND METHODS:** The first and second rays of embalmed feet (n = 5) were removed with an incision in the sagittal plane along the lateral aspect of the second metatarsal shaft, along with a coronal cut at their respective tarsometatarsal joints. The medial plantar artery and the dorsalis pedis artery were identified, cannulated and injected with a 50% barium sulphate gelatin solution. The injected specimens were then micro-CT scanned (SkyScan, Bruker, Kontich, Belgium). The scanned data was processed and segmented using Mimics software (Materialise, Leuven, Belgium). **RESULTS:** There were between one and three foramina, their sizes were recorded and compared to the caliber of the incoming nutrient arteries. The anastomoses between the vessels were also visualized to outline the arterial interosseous connectivity. **CONCLUSION:** These data inform the issue of arterial supply to the sesamoids, demonstrating the potential for the bones to suffer from arterial insufficiency from iatrogenic or traumatic causes. The data confirm the critical points of the sesamoids that should be preserved intraoperatively to help prevent avascular necrosis.

POSTER PRESENTATIONS – SESSION 4

"More experience gained in a comfortable environment": Preparedness for handling prosections and dissecting animal tissues in undergraduate science students

N. A. M. S. FLACK, B. J. HURREN, E. SUTHERLAND, F. NEUMAN, S. J. WOODLEY, and H. D. NICHOLSON
University of Otago, Dunedin, New Zealand

INTRODUCTION: Studying anatomy using cadaveric material and/or animal tissues provides unique but potentially overwhelming learning opportunities. Recent pilot data indicate that some undergraduate science students feel technically underprepared and/or wanting more information regarding support before undertaking these activities. In order to improve the student experience, we introduced a new prosection handling and dissection skills laboratory, alongside optional online support resources. We evaluated how prepared the 2019 cohort of anatomy science students felt upon entering their core second year paper (ANAT 241, which involves extensive prosection use and a rat thorax dissection), and whether the implementation of these new resources was beneficial. **MATERIALS AND METHODS:** All ANAT 241 students (n = 317) were invited to complete three surveys; one before, and after the skills lab, and one following the completion of the paper. Responses from open-ended questions were analysed by a general inductive approach, identifying common emergent themes. **RESULTS:** While anatomy science students felt reasonably prepared for prosections and dissecting based on prior experience in earlier courses, after completing the skills laboratory, decreases in stress levels and a positive shift in preparedness was observed, particularly with using dissection equipment. Only a small proportion (10.6%) of students accessed the online support resources – however, they were perceived as beneficial for those who engaged. **CONCLUSION:** The inclusion of a skills laboratory and online support resources has helped better prepare students for practical work that may have otherwise been a learning barrier. Promotion of online support resources is needed to improve comfort and support levels further.

What about me? Developing an evidence-based approach to identifying the needs of sessional anatomical demonstrators

R. A. BARTON-SMITH and Q. A. FOGG
Department of Anatomy and Neuroscience, The University of Melbourne, Melbourne, Australia

INTRODUCTION: There are numerous studies that explore the role of sessional educators. Most look at the effectiveness of the courses taught, the outcomes of training provided, and the role they may play in the academic hierarchy. The reviewed literature did not consider needs identified by the demonstrators, nor were they involved in the development of their training programmes. But how does such an approach get started? This study will look at the steps required to build a research project in this area and follow it through to its implementation. **MATERIALS AND METHODS:** Academics were interviewed regarding their perception of demonstrator roles, experience and expectations. A detailed literature review was conducted, exploring both sessional educator studies and the methodology required for modern educational research. The interviews and literature results were used to inform the design of focus groups and a demonstrator-specific questionnaire. **RESULTS:** The experienced academics agreed that formalized training and ongoing feedback is required for the demonstrators. There were differences in what level of learning/teaching theory should be provided, and variety in what was actually expected of the demonstrators in-class. The requirement for instrument validation and following published protocols was clear in the literature. **CONCLUSION:** The development of demonstrator-specific approaches to their training and work will provide a new perspective on how their critical role is maintained and grown. The steps required to establish a study of suitable contemporary standard have been outlined; it is hoped that these will help guide the development of other studies.

Delivery of a postgraduate surgical anatomy program

M. A. ZIMANYI and H. L. ANSCOMB
James Cook University, Townsville, Queensland, Australia

INTRODUCTION: It is well documented that anatomy delivery in medical courses has declined worldwide. In addition, with increased student numbers and increases in the cost of maintaining a bequest program, many anatomy programs have steered away from dissection and replaced some of the curriculum with alternative methods of delivery. This has resulted in more universities offering anatomy at postgraduate level. **MATERIALS AND METHODS:** Planning the course had challenges: the need to provide online delivery to allow those working in rural and remote areas access to the program but it's also suitable for the time poor. Tailored tutorials, clinical lectures and assessments prior to and during practical workshops were planned to allow adequate time to complete cadaveric dissection of the regions of interest. **RESULTS:** Delivery of the program is via distance mode (online) delivery divided into four modules, each with approximately 10 weeks of content comprising online recorded lectures that students can engage with anywhere, at any time. The compulsory practical component of the course involves full body cadaveric dissection, tutorials, clinical lectures and a range of assessments delivered during the 4-day practical workshop held at the end of each module. Unexpectedly, applications from a number of different allied health professionals were received, who were not the intended target group. **CONCLUSION:** Peer review from a senior member of the Royal Australasian College of Surgeons, a senior academic from interstate and student feedback is very positive.

Anatomical location and position of the appendix on magnetic resonance images and related pain characteristics in suspected acute appendicitis

M. CHAND[1], I. DEDOVA[1], S. AGGARWALA[2,3], P. WONG[2,3], J. NOL[2,3], N. YOUNG[2,4], and M. MOSCOVA[1,2]
[1]University of New South Wales, New South Wales, Australia. [2]Blacktown Mount Druitt Hospital Centre of Innovation for Advanced Imaging, New South Wales, Australia. [3]Radiology Department, Blacktown Hospital, New South Wales, Australia. [4]Westmead Hospital, New South Wales, Australia

INTRODUCTION: Acute appendicitis is the most common cause of acute abdominal pain and its diagnosis can be difficult in pediatric and gravid populations due to highly variable anatomical position of the appendix and non-specific symptoms. We investigated pain characteristics in patients with confirmed appendicitis and anatomical features of the appendix, including its location in relation to the vertebral level and its position in relation to the caecum. **MATERIALS AND METHODS:** A retrospective review of magnetic resonance images and medical records of patients who were clinically suspected of having acute appendicitis (n = 271) was conducted to describe the location and position of the appendix. Location of the appendix and pain characteristics were compared in the subgroup of patients with confirmed appendicitis by pregnancy, age and gender (n = 35). **RESULTS:** The most frequent position of the appendix in relation to the caecum was subcaecal (36%) followed by retrocaecal (25%). In the subset of patients with confirmed appendicitis, the location of the highest point of the appendix was significantly higher in pregnant women (L4 vertebral body) compared to non-pregnant women (L5 vertebral body), $P < 0.05$, while gender and age had no influence. There was no significant difference in appendicitis pain location across genders and age groups. In pregnant women, epigastric pain was more prevalent ($P = 0.01$) and typical presentation included moderate to severe sharp pain. **CONCLUSION:** The location of the appendix in relation to the vertebral level is higher in pregnant women and they present with different pain characteristics in acute appendicitis compared to other patient groups.

Tracking the growth pattern of the trachea in pediatric patients

C. BLYTHE and L. S. GREGORY
Clinical Anatomy and Paediatric imaging research laboratory, School of Biomedical Sciences, Faculty of Health, Queensland University of Technology, Brisbane, Australia

INTRODUCTION: Current endotracheal/intubation tube sizes for pediatrics are usually selected based on weight of the child, however this method does not predict tracheal circumference well. Little is known about the circumference of the trachea and its bronchi, and surface anatomy for endotracheal tube placement is not well defined in pediatrics. **MATERIALS AND METHODS:** We examined multi-slice computed tomography scans of the thorax of 63 males and females aged neonate to 19 years from the Queensland Children's and Mater Hospitals, Australia between 2012 and 2015. Vertebral levels of the sternal angle and carina were measured along with the circumference and angulation of the trachea and its bronchi in multiplanar formatting views in OsiriXTM. **RESULTS:** Despite high variability, the sternal angle and carina were most frequently located at T5. However, these levels displayed a significant age effect where vertebral level was more inferior as age increased. Tracheal circumference increased significantly with age and was significantly greater in males. Significant asymmetry was observed in the bronchial angle and circumferences with the left having a greater angle (4.3°+) and the right having a larger circumference (25 mm2+). Bronchial circumferences increased significantly with age and displayed a significant sex difference in the right. **CONCLUSION:** Our results suggest that the tracheal and bronchial circumferences are dependent on the age and sex of the child, the bronchi display significant asymmetry, and the sternal angle is an appropriate surface landmark for the carina. This knowledge is essential to improve intubation tube size and placement in pediatrics.

The anatomy of medial lenticulostriate artery (recurrent artery of heubner) with neurosurgical considerations: A meta-analysis

K. KRUPA[1,2], D. TATERRA[1,2], B. SKINNINGSRUD[1,2], J. TRYZNA[1], P. PĘKALA[1,2], J. A. WALOCHA[1,2], and K. A. TOMASZEWSKI[1,2]
[1]Evidence-Based Anatomy International Working Group; [2]Jagiellonian University, Medical College, Cracow, Poland

INTRODUCTION: The recurrent artery of Heubner (RAH) supplies the blood to the caudate nucleus (CN), putamen, internal capsule and globus pallidus. Surgical procedures on the anterior part of circle of Willis can result in damage or occlusion of RAH which can lead to hemiparesis or aphasia. The aim of the study was to examine the clinical anatomy of RAH through an evidence-based approach. **MATERIALS AND METHODS**: The major electronic databases were thoroughly searched to identify any relevant studies. Data regarding the type of included studies, prevalence, course, origin, symmetry of origin and number of RAHs in each hemispheres was extracted and included in a meta-analysis. **RESULTS**: A total of 28 studies (n = 3,335 hemispheres) were included in the meta-analysis and the pooled prevalence estimate (PPE) of RAH was 97.5%. Superior and anterior course in relation to ACA were the most frequent course patterns with PPE of 47.6% and 47.6%, respectively. The artery originated most frequently from the ACoA-ACA junction with PPE of 44.9%, followed by A2 segment with PPE of 42.3%. In 46.5% of the patients RAH had asymmetrical origin in both hemispheres. One RAH was observed in each hemisphere in majority of patients-78%. Duplication of RAH was seen in 17.3% of hemispheres, triplication in 2.1%.
CONCLUSION: The knowledge on the detailed clinical anatomy of RAH is necessary during neurosurgical procedures in the region to minimize possible complications due to its proximity to critical structures.

Tissue morphology, sensory innervation and vascularity of the shoulder bursae

M. S. KENNEDY, H. D. NICHOLSON, and S. J. WOODLEY
Department of Anatomy, University of Otago, Dunedin, New Zealand

INTRODUCTION: Shoulder bursae are relevant for physiological shoulder function, but their role in nociception, proprioception and the healing response of the rotator cuff is not fully understood. This study examined morphological parameters of the shoulder bursae including synovial tissue type and neurovascular structures using histological approaches. **MATERIALS AND METHODS:** Sections from 16 shoulders (eight embalmed cadavers, five female; mean age 78 ± 7.9 years) were obtained from the roof and floor of the subacromial bursa (SAB), coracobrachial bursa (CBB) and subtendinous bursa of subscapularis (SSB), and stained with hematoxylin and eosin (n = 139), von Willebrand factor (n = 43) and neurofilament (n = 28). Non-parametric tests were used for pairwise comparisons ($P < 0.017$). **RESULTS:** The main synovial type was areolar in the SAB (62%) and SSB (48%) and fibrous in the CBB (48%), with the roof predominantly areolar (47%–70%) rather than fibrous (22%–33%). Median blood vessel density was 3.0% (IQR 1.6–4.8), being greatest in the SSB roof (4.9%) and lowest in the CBB roof (1.6%) ($P = 0.014$). The SAB roof tended to be more vascular than its floor. Free nerve endings and nerve bundles were present in all bursae with an average density of 2.8 (range 0.4–11.8) per mm^2. **CONCLUSION:** Variations in synovial tissue and neurovascularity may relate to the location and function of bursae. The capacity to contribute to rotator cuff healing might be higher in the roofs of the SAB and SSB. The intrinsic innervation pattern supports potential involvement in nociception, while their proprioceptive qualities are unclear.

Well dampened blood pressure waves passing through the posterior cerebral artery prevent development of aneurysms

A. BURLAKOTI[1, 2], J. KUMARATILAKE[2], T. JAMIE[3], and M. HENNEBERG[2]
[1]School of Health Sciences University of South Australia, Adelaide, Australia; [2]Adelaide Medical School, The University of Adelaide, Adelaide,

Australia; [3]Magnetic Resonance imaging Centre, Royal Adelaide Hospital, Adelaide, Australia

INTRODUCTION: The aim of this project was to explore whether size differences of the first segment of the posterior cerebral artery (PCA) and the posterior communicating arteries (PcomA) influence the risk of having aneurysm distal to the second part of the PCA. **MATERIALS AND METHODS:** Diameters of first (P1) and second (P2) segments of bilateral PCA, PcomA and the internal carotid artery were measured perpendicular to the long axis of the vessels using image J software program, in 91 Computed Tomography and Magnetic Resonance scans of adult patients of both sexes (male = 36, female = 55). Relationships among P1, P2 and PcomA were determined by calculating P1/P2 and PcomA/P2 ratios. Positions and presence/absence of PCA, internal carotid artery and middle cerebral artery aneurysms were noted. **RESULTS:** The significant inverse relationship between right and left PcomA/P2 ratio and P1/P2 ratio was found (n = 91, r = –0.32, $P < 0.05$ and r = –0.42, $P < 0.05$ respectively). When one of the input arteries is smaller, the other is larger maintaining smooth blood flow into the posterior cerebral artery and reduce pressure fluctuations. Aneurysms were noted in multiple locations around left and right middle cerebral artery (aneurysms = 44) and internal cerebral artery (ICA aneurysms = 17) territories. No aneurysm was detected distal to P2 of PCA (n = 91). Pressure waves are well compensated before reaching the second part of PCA bilaterally preventing the development of aneurysms. **CONCLUSION:** The pressure dampening mechanism proximal to P2 segment of posterior cerebral artery favors a significant reduction in the risk of development of posterior cerebral artery aneurysms.

An anatomical investigation of the zygomatic foramina within a select South African population

J. S. LUCKRAJH, J. NAIDOO, and L. LAZARUS
Department of Clinical Anatomy, University of KwaZulu Natal, Durban, South Africa

INTRODUCTION: The zygomatic bone has several foramina namely the zygomaticoorbital (ZOF), zygomaticofacial (ZFF), and the zygomaticotemporal foramina (ZTF) which transmit the terminal branches of the zygomatic nerve. These foramina are encountered by surgeons and anesthesiologists during orbitomaxillary and maxillofacial procedures. However, recent studies have deemed these foramina unreliable surgical landmarks due to its variability in incidence and topography. Therefore, this study aimed to investigate the incidence of the zygomatic foramina and its location in relation to surrounding landmarks. **MATERIALS AND METHODS:** A total of 200 zygomatic bones were analysed (Ethics reference: BE123/19). The incidence of the foramina was classified as Types 0–5 and the distance from major anatomical landmarks were recorded. **RESULTS:** The relative frequency was as follows: Type 0- ZOF 85.5%, ZTF 96%, ZFF 21; Type 1- ZOF 13.5%, ZTF 1.5%, ZFF 39%; Type 2- ZOF 1%, ZTF 0%, ZFF 29.5%; Types 3, 4 and 5 were only found in ZFF in 7.5%, 2.5% and 0.5% of cases, respectively. The average distance of the ZOF, ZTF and ZFF from the inferolateral orbital rim was 18.0 mm, 26.2 mm and 8.19 mm, respectively. The average distance of the ZFF from the frontozygomatic, zygomaticomaxillary and zygomaticotemporal sutures was 27.6 mm, 13.0 mm and 23.7 mm, respectively. **CONCLUSION:** This study reported variations in incidence which agrees with the consensus that these foramina are unreliable surgical landmarks. Knowledge of these variations is useful to surgeons performing zygomatic osteotomies, maxillofacial reconstruction and transmaxillary approaches to the orbit in order to preserve the branches of the zygomatic nerve and prevent morbidity.

Distal tendon variability in extensor hallucis brevis and extensor digitorum brevis

C. PYMBLE, M. MIDWINTER, M. BENNETT, and R.C. ALAND
School of Biomedical Sciences, The University of Queensland, Brisbane, Australia

INTRODUCTION: Extensor hallucis brevis (EHB) and extensor digitorum brevis (EDB) lie deep to extensor hallucis longus (EHL) and extensor digitorum longus (EDL) tendons. EHB inserts proximally in the first proximal phalanx deep to the EHL tendon, while EDB inserts laterally into the EHL tendons, although variability is described. EHB and EHL both extend the first digit at the metatarsophalangeal joint (MTP) and EDB acts via the EDL tendon. EHB and EDB may therefore be functionally expendable; the variability of these distal attachments was explored to clarify the role of these muscles. **MATERIALS AND METHODS:** Distal attachments of EHL and EDL, and attachments and muscle segmentation of EHB and EDB were recorded in 19 paired feet (11 females, 8 males; mean age = 83, range = 58–95 years). **RESULTS:** Primary distal attachments of EHL and EHB followed previous descriptions. Primary distal attachments of EDL and EDB divided and inserted on the proximal portions of the middle and distal phalanges, EDL positioned medially and EDB laterally. Additional attachments terminating at the MTP were common (EHL (68%), EHB (18%), EDL (26%), EDB (29%)). Supernumerary bellies (EHB and EDB =16% of specimens) also terminated at the MTP. **CONCLUSION:** Primary distal attachments of EHL, EHB, EDL, and EDB were consistent; although additional attachments were common, potentially contributing to previously reported variability. Primary distal attachments of EDB were more extensive than previously reported. However, given the size of EHB and EDB, substantive roles in movement appear unlikely, suggesting other possible roles (such as proprioception) in gait.